SEVENTY-THIRD YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXVII. NUMBER 12

NEW YORK, SEPTEMBER 22, 1917

10 CENTS A COPY
$4.00 A YEAR

What happens to an Allied aviator attempting a "tail attack" on the German Gotha battleplane. By means of a machine-gun tunnel the rear gunner of the Gotha can bring his fire to bear on what is generally a "blind spot"

Germany's Gotha Battleplane and its Machine-Gun Tunnel

IN the air, too, Germany has proved a formidable foe: both in numbers and in quality her aircraft production has always been able to keep pace with the Allied nations, or at least so close to them that they have never had things all their own way in the skies. German constructors have always succeeded in matching machine with machine, armament with armament, and speed with speed. Every time the Allies have introduced a new and formidable aircraft, the Germans, following their initial surprise and embarrassment, have always responded with a suitable equivalent to offset the temporary Allied advantage.

Just now it is the Gotha three-seater battleplane which Germany is using as a challenge to her aerial foes. The usual Gotha measures about 75 feet from wing-tip to wing-tip, and 38 feet in length. The machine is of the biplane type, and the upper wings are provided with huge ailerons which extend slightly beyond the lower ones.

The body of the Gotha is of special interest. While the two passengers (one in front and one behind the pilot) evidently sit in the center of the axis, the pilot's seat is placed at the left, so as to g ve room for a gangway enabling the occupants to pass from one end to the other. The armament consists of three machine guns. One of them, placed in a turret in front fires forward and, at certain angles, both above and below the wings. Two other machine guns run in grooves on two transverse tubes fixed behind the rear passenger—one above the body and the other nearly level with the floor, which is here deeply hollowed out to form the gun-tunnel described later on. It is thus possible for the Gotha to fire at the sides, underneath, upward, and to the rear; indeed, it is a machine for all-round fire.

The bomb-dropping apparatus is arranged to carry twelve to fourteen bombs, or a total of eight hundred to one thousand pounds of explosive. These bombs are carr ed inside the body of the machine, between the pilot and rear-gunner's cockpits. Arranged horizontally on racks in two tiers, one each side of the fuselage, the bombs can be released in quick succession. When one bomb is released the next above automatically slips into the position vacated. In addition to these two main magazines, the Gotha bombing-plane carries two bombs under the forward cockpit, in tunnels built into the floor of the fuselage and held by spring clips or collars. Essentially, this machine is a bombing-plane, and as such it is being used in the aerial raids on London instead of the Zeppelins which appear to have been dropped for this class of work.

The power plant of the new Gotha consists of two Mercedes motors of 260 horse-power each, placed one on either side of the body at a distance of somewhat over six feet from the axis. The motors are encased in armored nacelles, each of which carries its own landing gear which serves as part of the landing chassis for the entire machine.

But the main feature of the Gotha is to be found in its machine-gun tunnel, which makes it a formidable antagonist since it has no so-called "blind spot." Most aeroplanes have a "blind spot" under the tail, which means that their machine guns cannot be brought to bear on a target situated on a line with the tail members, since to hit the target would mean shooting off one's rudder or elevator. It is this very feature which determines aerial battle tactics to a great extent; for the prime effort of an airman is to maneuver about until he succeeds in reaching a position in back of his opponent, either above or below the tail, so that he can shatter his opponent with machine-gun fire while enjoying immunity from retaliatory fire. This is the practice known as "sitting on the enemy's tail."

In the Gotha battleplane, however, the enemy airman attempting the usual tactics receives a rude, and perhaps fatal, surprise. The fuselage of the new German machine is vaulted below like a tunnel, along which a machine-gun is trained to meet a "tail attack." Normally, the rear gunner operates a machine gun above the fuselage in the usual manner; but when a hostile airman attempts to seek shelter below the tail the rear gunner of the Gotha goes below and uses the machine gun in the tunnel, as shown in the accompanying illustration. Thus this latest battleplane is not hampered by "blind spots," and therefore possesses a tremendous advantage over the usual battleplane with one or more "blind spots."

A Theater Without Footlights

A LARGE Philadelphia theater is to be the first one in the world to be operated without footlights. All the stage illumination will come from above, being as nearly as possible a reproduction of ordinary sunlight. The innovation of taking away the footlights comes as a general surprise to theater goers, violating as it does one of the traditions of stage art.

The system employed, covered by patents both here and abroad, demands a long steel bridge, of cantilever construction and 10 feet wide, which is thrown all the way across the proscenium arch directly behind the curtain. In the present instance this bridge will be 98 feet in length, and the steel construction will be of the heaviest. On the bridge will be stationed 80 electricians, each handling two lamps, pointed downward and manipulated much as a soldier might aim a machine gun. The rays of light completely envelop the characters on the stage below, and explore every corner of the stage. It is just as though an enormous sun were above the players. The effect is described as the most natural lighting ever seen in a theater.

The combined candle-power of these lamps is 160,000, and the electric current used at each performance would carry a submarine across the Atlantic or illuminate two large metropolitan hotels for 24 days.

SCIENTIFIC AMERICAN

Founded 1845

Published by Munn & Co., Inc., 233 Broadway, New York, Saturday, September 22, 1917

Charles Allen Munn, President, Frederick C. Beach, Secretary, Orson D. Munn, Treasurer, all at 233 Broadway

Entered at the Post Office of New York, N. Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

Mr. Daniels and the Navy League

WHAT is to be the future of the Navy League? This is a question which is on the lips of many Americans, who have watched with amazement the occurrences of the last few weeks. An event has taken place which we believe is without parallel in the history of our country. An effort has been made by the Secretary of the Navy so to cripple the activities of a patriotic organization that its usefulness will be brought to an end.

Some years ago a few wise men, who had greater foresight than their neighbors, appreciated the vulnerability of the United States and decided that the upbuilding of our Navy should be the primary method of defense against an aggressive enemy. With this view in mind the Navy League was formed, and it has been an efficient instrument in educating and enlightening the public upon the necessity of having a Navy representative of our greatness, and its aim has been not only to upbuild this arm of our defense but to point out and eradicate defects of policy and material. When the war clouds gathered in 1914, the activities of the League were quickened and the scope of its work many times enlarged. Its membership comprises at the present time 300,000 members, and among them may be found many of the most prominent and public spirited men and women in this country. Meetings have been held under its auspices in all the prominent cities, a magazine is published for the purpose of disseminating knowledge about our Navy; it has been active in promoting enlistments in the different branches of the Navy service; it has furthered plans for obtaining gifts of clothing, sweaters, kits of various kinds, and miscellaneous outfits for our sailors. Thousands of women are working now in the preparation of material comforts for our sailor lads. The work that has been carried on has been purely voluntary and for the benefit of the service alone.

In view of these facts the question naturally arises: why should the Secretary of the Navy endeavor to nullify or destroy the work of the League, and has he or has he not exceeded his official powers in the stand he has taken? By a proclamation which he has issued he states that, because certain statements made in connection with an explosion of a powder magazine at the Mare Island Navy Yard were incorrect and contrary to facts, "in future no officer, agent or representative of the Navy League will be admitted to any naval station, naval reservation, or ship of the Navy" and that the gifts which have been prepared by the women members of the League for the comfort of our sailors should not be accepted from the organization as at present officered and managed. It would appear that the Secretary has gone beyond his prerogative in the drastic measures which he has taken to rebuke the statements made in the bulletin of the League. It appears that the accusations brought in the bulletin have been withdrawn, and in the September issue of *Sea Power* appears an apology for the statements made.

It is true, perhaps, that the League has not been in sympathy with the Secretary of the Navy. It has doubtless felt that the interests of the Navy were being jeopardized by the retention in office, as the head of one of its most important departments in war times, of one whom the League has regarded as a man of too many limitations to handle the gigantic work which is placed upon his shoulders. This feeling of uneasiness and distrust is shared by a very large part of our thinking community. The Secretary has shown himself to be democratic and cordial in his personal attitude towards the common sailor, but a most independent autocrat and disciplinarian as far as the service in general is concerned, and particularly when his own personal position was involved. This is amply proved by the disciplining process which he has used towards some of our high ranking officers who have drawn attention to certain defects of our Navy and thereby incurred his displeasure.

The destruction or impairment of the Navy League would be a distinct loss to the country and to the Navy itself, and the obnoxious order which he has promulgated should now be withdrawn in view of the retraction made by the officers of the League.

The demand made by the Secretary of the Navy that the officers of the League should resign is a distinct interference with the rights and privileges of the League, and is a new method of warfare conducted by the head of a great department of our Government against an independent and patriotic society. If such a method of coercion is to be countenanced and is to be submitted to by our people, is not a precedent being established which is most dangerous to the liberties of the public? If the work of this Society is to be crippled or destroyed because the Secretary wishes to inflict punishment upon the President of the League, might we not expect that some other department head of our Government might demand the resignation of the officers of the Red Cross or the Allied Relief Society or some similar association, because of a personal grievance? The practice which has been introduced by Mr. Daniels is too dangerous a one to be passed over in silence or ignored by the people of the United States.

The Patriotic Cooperation of Our Railroads

WE may boast that the United States has more railroad mileage than all of Europe put together, but we are apt to overlook the fact that all of Europe which is confined between the fighting lines could be lost within the valley of the Mississippi. Considering our vast area, we do not begin to have the mileage of Great Britain, of France or of Germany.

When the war broke out between the United States and Germany our railroad conditions were in a badly tangled state. Freight was piling up at our terminals faster than it could be moved; cars were tied up for weeks in our freight yards and there was a serious shortage for service on the road. The prospects were hardly encouraging, for it was realized that with our entry into the war there would be an enormous increase in the demand for transportation. Factories would be operating at the height of their capacity, there would be enormous shipments and extensive traveling from one part of the country to the other, and above all, there would be huge bodies of troops to be moved hither and thither with their camp equipment and supplies. It was but reasonable to expect that our railroads would be unequal to the demands of the war and that our preparations for active service abroad would be tied up indefinitely by the lack of railroad facilities at home.

Shortly after the declaration of war a Railroads' War Board was organized to handle the situation and secure the necessary coöperation between the many different railroads of the country. A vast force of 1,750,000 men, including all persons employed by railroads, from the presidents down to the engine wipers, were consolidated into a single army of patriots willing to forget private competition and to devote themselves to the needs of their country.

A report has just been issued by this Board showing what has been accomplished in the past four months. The car shortage has been reduced 70 per cent, all passenger trains that could be dispensed with without serious inconvenience, were taken off the schedule, with the result that there has been a saving of approximately 20,000,000 miles of train service per year. Freight congestion has been relieved by moving empty cars from one railroad to another, irrespective of ownership. Under the direction of the Board, 113,420 empty freight cars have been moved into districts where they were most needed. There has been a large saving of cars through the pooling of coal and of ore. Although there has been an abnormal movement of grain this year, the number of cars employed in this service has actually been reduced. The coöperation of shippers has been sought; they have been urged to "make one car do the work of two." As a result the average carload of flour has been increased from 46,250 pounds in 1916 to 61,923 pounds this year. New Orleans sugar cars used to carry only 40,000 pounds on the average, while now this load has been doubled. It is the exception to find a car in these days that is loaded below the marked capacity.

In the transportation of troops our railroads are called upon to move a million men from nearly 5,000 points to the 32 training camps of the National Army and National Guard, by October 20th. Experienced railroad men have been sent to every cantonment, not only to aid the Quartermasters in maintaining the necessary military supplies, but also to assist in the intelligent handling of construction materials in the building of these cantonments.

The report of the Railroads' War Board is an inspiring bit of reading. It furnishes us an example of American adaptability. It shows that patriotic coöperation can attain a degree of efficiency that had been considered impossible except under direct Government ownership and operation.

What of the German High Seas Fleet?

THE world has been so filled with the unlawful exploits of the German submarines in their attempt to put the world's shipping at the bottom of the ocean, that it seems to have forgotten the existence of the German High Seas Fleet, which was built for the purpose of fighting enemy warships in a lawful contest for the command of the sea. During all the years in which Germany was creating this fleet, the German people were told that, in the great world war, whenever it came, the navy would play a most important, if not a decisive part. The opportunity came in the month of June, 1916, when the fleet, being at that time at the very zenith of its strength and efficiency, came boldly out into the North Sea for a deliberate trial of strength with the British Grand Fleet.

After that memorable battle, the Kaiser congratulated the German people on the fact that their navy had won a "brilliant victory" over the enemy. That success was gained some fifteen months ago, and during all this long-drawn-out interval the world has had neither sight nor sound of the victors. So far as any operations on a grand scale of the German Fleet is concerned, it might just as well have been lying at the bottom of the North Sea.

Why this silence as of the grave? Why this complete immobility of the second greatest fighting fleet in existence? If the battle of Jutland had been a victory for the British, and the High Seas Fleet with a loss of many of its capital ships, and the smashing up and disablement of many others, had been driven back in utter defeat, to seek refuge in its naval bases, we could have understood this prolonged silence and inactivity. But, in view of the fact, as the Kaiser announced, that the German fleet had been brilliantly victorious, its present supine inactivity, at the very time when the German army is being slowly beaten to its knees by an overseas enemy, is one of the most profound mysteries of the war. If the German High Seas Fleet delivered such a smashing blow against the Grand Fleet, why, after returning to its base for repairs and refitting, did it not at once come forth to inflict another crushing blow upon the already defeated enemy? The punishing power of the modern gun and torpedo are such that a "brilliant victory" implies the wholesale sinking of enemy ships and the crippling of many more, to say nothing of the breaking down of the enemy morale. If the Germans were able to crush the British Fleet in the heyday of British strength and confidence, how much greater would be the victory of a second attempt against the now weakened and discouraged foe?

The complete immobility of the German Fleet becomes the more amazing when we contemplate the stupendous results which would follow another German victory; for in this second attempt, after completing the disruption of the Grand Fleet, the German Commander-in-Chief would be in a position to lead his victorious squadrons to the English Channel; cut through and break up the vast system of ferriage between England and France; immobilize that part of the British Army which is within the British Islands; and absolutely stop the flow of supplies to the army in France.

Thus, at a single stroke, would her navy neutralize the whole military and economic effort of the British Empire; for, with the main artery between England and her army cut in twain, the British troops in France would quickly and literally bleed to death. Nor would the fruits of lawful German victory upon the high seas stop here; for, moving out into the Atlantic, she would be able in twenty-four hours to bring about, lawfully, that immobilization of the United States, which her submarines have been unlawfully and hopelessly attempting to achieve during the past six months.

Here is a prize of war, the like of which never presented itself in all the long history of naval warfare. What Germany's hard-fighting armies have failed utterly to accomplish in three years of effort, her fleet, swinging idly so long at its moorings in Kiel Harbor, could have accomplished in any twenty-four day during the fifteen months that it has chosen to remain in its present condition of inglorious obscurity.

Nor would the fruits of a second "brilliant victory" be limited to the starving of the French and British Armies and the shutting of the United States entirely out of the European battlefield. For there are hungry mouths in Germany, these days, whose emptiness would be filled to repletion were the seapower of the enemy broken. The portals to the highways of the seven seas would be flung wide, and the German ships would once more be free to fetch and carry to and from all the corners of the earth. Overwhelming victory for her armies; food for her people; trade and commerce for her idle markets and her ships now rusting in silent harbors. Surely these are worth the effort of another "brilliant victory."

Again we ask, why this silence on the part of a victorious fleet, when one more such decisive sortie and "steel-hard" blow from the "mailed fist" would win everything in the way of world dominion of which the wildest military enthusiast at Berlin ever dreamed.

Astronomy

A Huggins Memorial.—A medallion in memory of the late Sir William and Lady Huggins was unveiled in the crypt of St. Paul's Cathedral, London, on March 29th, in the presence of many distinguished astronomers and representatives of other sciences.

The Astronomischer Jahresbericht.—This indispensable annual digest of the literature of astronomy has continued to appear in spite of the war, the volume for 1916 having been issued not long ago. Many papers not available to the German editors were reviewed by colleagues at the observatory of Copenhagen.

Astronomer Victim of an Air Raid.—The *Journal* of the British Astronomical Association reports that Mr. Richard F. Roberts, a member of the association and also a fellow of the Royal Astronomical Society, was killed in the aeroplane raid on London, June 13, 1917. His daughter was killed in another house during the same raid. Mr. Roberts was an amateur astronomer and took part in an eclipse expedition in 1900.

A Star Belonging to Two Constellations.—One of the special curiosities of the fantastic grouping of stars in constellations which we inherit from our ancestors is the fact that the second-magnitude star Beta Tauri,or El Nath, is also Gamma Aurigae; *i.e.*, it is in two constellations. The last number of *L'Astronomie* reproduces charts of Taruus and Auriga from Bayer's atlas of 1603, in which Greek letters were first applied to the stars, and here we find the curious feature above mentioned. The bright star in the upper horn of the Bull in one drawing is identical with that in the left heel of Auriga in the other. Nowadays it is more usual to assign this star to Taurus, and to leave Auriga without a Gamma.

Origin of Life on Planets.—The many speculations that have been published concerning the origin of life on the earth and on any other bodies in the universe where it may possibly exist usually assume that, in some way or other, "life germs" are transported across the gulfs of space from one planet to another. Thus it has been suggested that life may have been brought to the earth in meteors. One of the most recent suggestions is that minute "life germs" may escape from the atmosphere of a planet in which life exists, just as molecules of the atmospheric gases are believed to escape from our terrestrial atmosphere, and may be driven by light-pressure to some world where physical conditions have become suitable to support life. While there is nothing essentially absurd in these hypotheses, it is not clear why their authors should take it for granted that life cannot originate *de novo* on a cooling planet.

Telephonic Time Service in Switzerland.—Immediately after the outbreak of the European war the government of Switzerland suspended the operation of private wireless stations throughout that country. One result of this step was to prevent the receipt of the daily wireless time signals from the Eiffel Tower, in Paris to the considerable inconvenience of the Swiss watch and clock makers, as well as many other persons who had been in the habit of receiving these signals. In order to remedy this situation, the federal telegraph and telephone service installed at Berne automatic apparatus, designed by E. Nussbaum, whereby the wireless time signal received by the official station at that place from Paris is conveyed over the telephone lines to telephone subscribers who desire it. This plan has been in operation since May, 1916, and astronomical observations made at the federal observatory in Zürich show that the accidental errors involved in the transmission of the signal rarely exceed a tenth of a second.

Hubble's Variable Nebula.—This nebula (N. G. C. 2262), which is bright and comet-shaped, has a nucleus which has long been known as the variable star R. Monocerotis. The nebula is of the same class as N. G. C. 6729, the variability of which was studied photographically by Knox-Shaw at Helwan, as previously reported in these columns; Hubble's nebula is, however, larger and brighter and hence more easily studied in detail. Hind's variable nebula, near T. Tauri, appears to be a third member of this interesting class of celestial objects. Changes in the outline and structural detail of N. G. C. 2261 have been traced by the comparison of photographs taken at different times by E. P. Hubble and others. Some striking though small changes occurred between 1908 and 1913. Between March, 1916, and January, 1917, remarkable apparent displacements amounting to as much as 15 sconeds of arcs were shown by plates taken at the Lowell Observatory. On March 27, 1917, Hubble secured a new plate with the Yerkes 24-inch reflector. The nucleus was distinctly brighter than in the previous year, at least in comparison with the neighboring nebulosity. The nebula had faded greatly all around its southern perimeter, and changed markedly in shape near the nucleus. If these changes represent actual movements of matter and not merely changes in illumination, then the nebula must be very near; a velocity across the line of sight of 500 kilometers per second would indicate a parallax of at least 0.2 second.

Science

Bogus Salvarsan.—The New York City Department of Health has unearthed a sensational fraud in the manufacture of fake salvarsan. The imitation, which was put up in New York and sold widely throughout this country as well as in Canada, Mexico and Central America, consists of ordinary table salt colored with a little aniline dye. The package, circular, ampoul and every visible detail of the original article are cunningly imitated. It is believed that at least 50,000 doses of the fake article have been sold.

A Revised Chart of New York Harbor, on a scale of 1:40,000, has been issued by the U. S. Coast and Geodetic Survey. The labor involved in bringing such a chart up to date is illustrated by the fact that in one year there have been for this chart 253 different items of change, which required 233 working days to compile and engrave. Marked changes in the contour of the bottom, disclosed by recent surveys, are shown at the entrance between Sandy Hook and Coney Island. The most remarkable changes from the previous map are found along the shores of Arthur Kill, Newark Bay, Kill Van Kull, and the west side of the Upper Bay, where the rapid development of great railway terminals and manufacturing enterprises is transforming the whole appearance and character of the waterfront.

Standard Time Chart of the World.—The French navy having recently adopted the use of standard or zone time at sea, the Hydrographic Service of the French Ministry of Marine has just issued a large chart of the world, on the Mercator projection, showing the limits of the standard hour zones on both land and sea, together with other pertinent information. The land areas in which standard time is used are indicated by red tinting for the even-numbered zones (beginning with zone 0, in which Greenwich time is used), and blue for the odd-numbered zones. Violet tinting is used in the case of countries such as British India, Nigeria, British East Africa, and Venezuela, in which the legal time is intermediate between that of two standard meridians. Countries not using zone time are tinted yellow, and in case they use a uniform official time the difference between such time and that of Greenwich is indicated; also the location of the observatory, if any, from which the time is taken. The price of the chart is one franc.

Rhubarb Leaves as Food.—Attempts have recently been made in England to establish the use of rhubarb leaves as "greens," and the statement has been made in some quarters that this is the revival of a practice dating back as far as the days of Queen Elizabeth. It appears, however, that such food is decidedly dangerous The English newspapers have reported several cases of illness and at least one fatality following the eating of rhubarb leaf-blades (as distinguished from the leaf-stalks, which are a familiar article of food in both Europe and America). A long article on this subject appears in *Nature*. The statement that rhubarb leaves were used as a pot-herb in Queen Elizabeth's time is probably erroneous and based on a confusion of the rhubarb with other plants. The young inflorescence of this plant has sometimes been eaten without producing ill effects, but in other cases has caused serious illness. *Nature* cites several cases, in England and America, in which the eating of rhubarb leaves has brought on serious illness, probably on account of the large amount of oxalic acid they contain. Indeed, the leaf-stalks, which we know so well in "pie-plant" pie, are not altogether free from suspicion.

Occupation and Mortality in New York City.—Drs. Wynne and Guilfoy, of the New York City Department of Health, have made a preliminary study of the relations of occupation to mortality as indicated by the mortality returns of the city for 1914. Several important factors in the problem are not brought out by the statistics available, but general conclusions of some value can be drawn from the results. Thus it is evident that mortality of the respiratory diseases is highest in occupations carried on in crowded and badly ventilated offices and shops. Garment workers, however, are an exception; the low mortality from pulmonary tuberculosis and pneumonia among workers of this class, most of whom are Jews, is ascribed to a racial immunity. Mortality from cancer is relatively low in the strenuous occupations and high in the sedentary ones. There seems to be an unduly high mortality from heart disease and Bright's disease among cigar workers, tobacco workers and garment workers. Alcohol seems to be an important hazard among bartenders and teamsters. Lobar pneumonia seems to be a hazard in two classes of occupations; viz., those in which the workers are grouped together in shops and offices, and those in which the workers are alternately exposed to high and low temperatures. Apparently the occupational poisonings, such as chronic lead poisoning, arsenic poisoning, etc., form but a very small factor in causing mortality among the workers of New York city. Statistics of this kind are of great value in indicating where, and what, remedial measures are most needed.

Industrial Efficiency

Grinding Wheel and Automobile.—In the manufacture of the modern automobile the grinding wheel plays a most important part. In one typical plant, for instance, the grinding wheel stock room contains an elaborate system of racks for the wheels, and the statement is made that there are now in use 54,491 grinding wheels. In addition there are 22,479 disk wheels for use in buffing and polishing. The total value of grinding wheels and polishing wheels is $95,752.85.

Saving Waste Paper.—Even in the best managed organizations there are numerous printed forms and letter-heads which are discarded from time to time. With a view to salvaging the paper represented by discarded stationery, there has recently been introduced a simple device for the making of pads or tablets. Discarded stationery of one size can be assembled and pressed together, and glue and a strip of cloth applied to one edge, forming a serviceable pad. The device is so simple that it can be operated by anyone.

Speeding up Gaging Work.—There has recently been developed an amplifying gage which is said to simplify and expedite this phase of machine work. Accommodating work up to 5 inches on the plate and up to 8 inches between centers, this machine will take the place of 75 per cent of the snap gages now in use. It operates with extreme rapidity and offers no chance for guesswork, as the measurements are taken by a direct-reading indicator on a dial which is divided in 1/16-inch graduations. The gage measures to 0.0001 inch, has a wide range of application, and all parts subject to wear are made of hardened steel.

Women as Welders.—The British Ministry of Munitions have taken over all expenses connected with the training school for women welders at Notting Hill Gate, organized by the Women's Service. This is on the condition that at least twenty women are in constant training. This arrangement is said to be giving complete satisfaction. The Ministry have added new blow-pipes and plant, and the securing of sufficient oxygen, acetylene gas, and scrap metal is no longer a difficulty. About 200 skilled welders have been trained in the school, and are now doing useful work. Aluminum welding is being taught with success. It is difficult, but the women are doing well in aeroplane factories. The students are booked two or three weeks ahead of the completion of their training.

Our Greatest Enemy.—Comparatively few persons realize how great a toll industrial accidents take of our people every year, states Secretary Redfield. If we are ever so unfortunate as to hear of the loss in a great battle of say 10,000 of our soldiers (10,000 killed) the nation would be moved deeply; yet every year twice, perhaps three times, that number are slain in industries of all kinds and almost without its invoking comment. If we were to hear that 1,000,000 of our men suffered wounds in this war, the nation would be troubled; yet industry takes its toll in the form of injuries to persons to an extent nearly three times that number every year. Of this we think but little. There is a real danger, therefore, that in our sympathic and proper thought for the soldier in the field, we may lose sight of the soldier in the factory, who has his casualty risks as well as his brother in arms. Just as there is a call to service for the soldier and the financier and the nurse and the doctor and the engineer and the mechanic, there is a call to service to see that the precious lives of the country are not wasted and that the bodies of the precious people who make up this country are not crippled.

Help Save Gasoline.—After a careful investigation of the present gasoline situation, Mr. Van H. Manning, Director of the Bureau of Mines of the Department of the Interior, has issued the following statement: One half of the gasoline used in the United States (1,250,000,000 gallons) is used in pleasure riding. It is estimated that the United States Army will need 350,000,000 gallons for aeroplanes, trucks, automobile tractors, and other machines. There is no way of obtaining this in this country except by saving from the existing supply, and this economy may be procured by voluntary cutting down of pleasure riding (for instance, the man who takes his family out on Sunday for a 50-mile ride can cut this in half). It has been estimated that by economical use enough gasoline can be saved to supply not only the United States but also its allies for war purposes. The following suggestions should be observed by automobile owners: Do not allow engines to run idle. Use kerosene, not gasoline, for cleaning purposes in the garage. See to it that the carburetor does not leak. Form the habit of shutting off the gasoline at the tank. By judicious regulation of the mixture of gasoline and air in the motor, both greater power and economy of fuel may be obtained. Automobile owners need not lay up cars, but should use them either for trade or pleasure purposes thoughtfully and judiciously. If this advice is followed there will be no undue scarcity, for the United States possesses an abundant supply for ordinary purposes.

Bringing in the lumber. A temporary tram takes the place of the familiar corduroy trail through the woods

Caught in the act of felling a tree. The saw, not the axe, does the bulk of this work

Fighting With Axe and Saw

A Regiment of American Lumberjacks and Foresters for European Service

By C. H. Claudy

THAT the arts of peace become the science of war has been daily demonstrated during the period of the great conflict, but it comes as a distinct surprise to many ears to hear that the United States has recruited and is now training a "regiment of lumberjacks" for intensive lumbering and forestry work in France.

The forest regiment or, as the War Department designates it, the Tenth Reserve Engineers (Forest), has been organized at the especial request of General Bridges, a member of the Balfour Commission, which lately visited America. It is officered by two regular army officers, fifteen foresters from the United States Forest Service, two from the Forest Branch of British Columbia, one lumberman from the Indian Forest Service, and thirteen foresters or skilled lumbermen taken from civil life.

The regiment is a full grown organization, including over 1,000 men besides its regimental and staff officers. The great majority of these are skilled woodsmen who have been most carefully selected for age, health, strength, skill and knowledge.

The regiment is made up of six companies of 164 men each, aside from battalion and regimental staffs, drivers, and commissioned officers. It will be sent overseas as soon as it is fully trained and completely equipped, probably early in September. Assembling at two training camps, one battalion at the American University, Washington, D. C., and one at Fort Leavenworth, Kan., training work is in active progress as this is written.

While designed to serve primarily as a mobile logging and milling crew, the regiment is organized on military lines and its members are uniformed and armed like other units in the United States Army. Its officers and men are rapidly learning military discipline and teamwork through thorough-going drill at the training camps.

The officers of the regiment have no knowledge as yet as to whether their work will take them under fire or not. Because of the extinction of such forests in the fighting area it seems probable that much of the work will be done many miles back of the fighting line, but it may be necessary for lumbering operations to be carried on within reach of the enemy's shells and every man who has enlisted is prepared for that eventuality.

Because of the opportunity for service by this country in woods work incidental to the war which the request of the British Government for the organizing and sending of a forest regiment was believed to present, Mr. Henry S. Graves, chief of the United States Forest Service, has been granted leave of absence and received a commission as Major in the Reserve Engineer Corps. He is now abroad, not assigned to command, but in France to learn on the ground in advance just what conditions will need to be met by the regiment and how extensively its services can be utilized to advantage.

Typical New England logging scene in a woodland tract in Old England

There seems little doubt that the regiment will have plenty to do—the Canadian lumber regiments have been extremely busy, and of course the army of "Sammies" will add to the demands for cut wood.

This demand for lumber both on and behind the lines is something almost inconceivable. There are hundreds of miles of trenches which are not only floored with timber but walled with it on both sides. The mining operations which are continually going forward require very heavy and strong timber to shore up the tunnels as they are pushed forward by sappers. Thousands of dugouts leading off from the trenches are both walled and roofed with timber which must all come from behind the lines, and a good way behind at that, because modern military operations, when passing over a forest, leave little for the lumbermen but charred and black stumps.

The need for boards is hardly more than the demand for heavy timbers. A large mileage of small railroads is utilized by the armies in the field and every time the front is advanced or conceded, new miles of these narrow gage roads have to be built. Of a temporary character, these little railroads are used for the vital purpose of carrying ammunition and supplies up and down the line, from the supply depots, and of course they require a large number of ties. Cord wood for fires is in great demand and telephone and signal poles are required almost as fast as they can be cut. This variety of work, of course, is more to be done with the axe and saw, and does not require the services of a mill at all. It does, however, require transportation on the instant and without waiting for any tramway. Thus at least 450 horses will accompany the regiment when it goes to France.

Because of the character of the wooded areas and forests in France the equipment to be carried by the forest regiment is all of the most mobile character. Wood lots, wooded areas and forests in France are comparatively speaking, small; large stretches of heavily wooded land are conspicuous by their absence. As a result no lumbering operations with any permanent headquarters, such as we are accustomed to hear about in our own heavily forested land, can be contemplated.

The work will be done largely in sprout forests of oak, beech, hornbeam, and other hardwoods, with some stands of pine. The timber is small in comparison with most American forests, much of it from 8 to 12 inches in diameter. These forests resemble the woodlots of southern New England, and the operations will be

(*Concluded on page 215*)

Horses helping out in getting the logs aboard flat cars for hauling to the mill

Loading the sawn lumber in motor trucks for transport to the front

Saving Ships from the Sands

How a Big Dredge Freed a Vessel That Had Lain High and Dry for Ten Years

SAND—soft plastic sand—has been the bane of wreckers for generations. In many instances it has proven a more formidable obstacle than rock or reef. A rocky shore holds a vessel rigid and permits the free movements of divers as they labor to seal up the holes in the hull and to break away the obstructions that hold her captive. On the contrary, when a ship strikes a sandy shore, every movement tends to bury her deeper. The waves redeposit the sand about the hull almost as rapidly as it can be removed and in addition begin at once to build a barrier between the vessel and the sea. Pontoons and other lifting devices are generally useless, bulkheads of no avail and divers impotent.

But just as gigantic centrifugal pumps and the use of concrete for patching up holes revolutionized wrecking operations on rocky shores, the big suction-dredges are proving the salvation of ships stranded on level, sandy beaches. On the Oregon coast alone, many fine ships, driven high on the sands to become helpless wrecks within recent years, could readily have been salved had the present efficient dredge method been available.

The plan of operation is very simple. As soon as word is received that a vessel has gone ashore on a sandy stretch of coast, a suction-dredge is hurried to the scene. Before the craft has had time to sink to any considerable depth or the waves to form a shoal, a channel is dug in the yielding material and the vessel pulled into deep water by the waiting tug-boats.

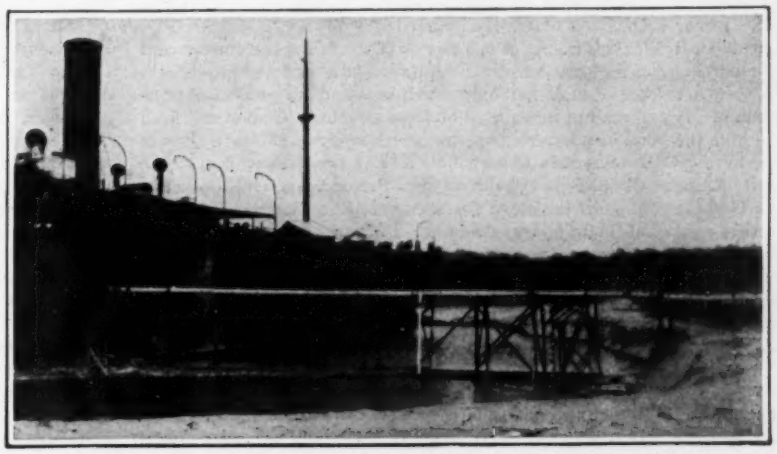
During the past year two steamships that had struck on a sandy point in the Strait of Juan De Fuca were speedily released by dredges. Without such prompt aid, it is probable that the vessels would have been broken up by westerly gales, like the many others that had stranded on this particular sand-spit. The greatest feat, however, to the credit of the dredges is the release of the steamship "Sesostris," which had been stranded on the coast of Guatemala for nearly ten years.

On September 15th, 1907, this vessel, a Kosmos steel freighter of 4,718 tons, while loading coffee at the port of Ocos, was torn from her moorings by a terrific storm and carried high and dry on the sandy shore. Her cargo was removed and three salvage companies tried in turn to effect her release without results. Although seemingly a hopeless wreck, the vessel was never abandoned by her owners. A trusted employee was always kept on board with special instructions to keep the machinery in as good condition as possible. At one time the care-taker put a gang of Guatemalans at work removing sand from about the ship. A basin was constructed in which the vessel half-floated; but the task of cutting through the sand barrier with their limited equipment proved too great, and the work was given up.

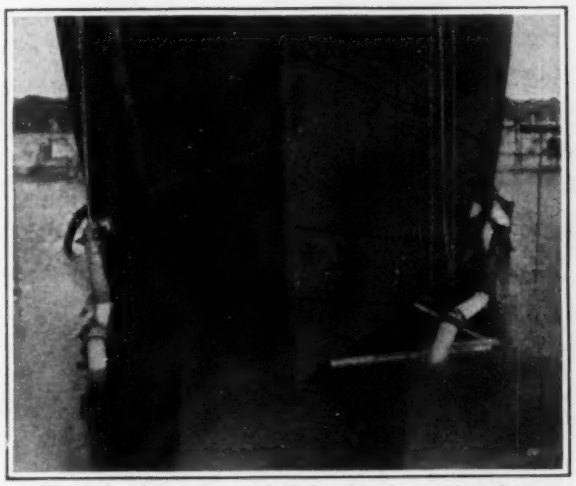
The "Sesostris" had become almost forgotten when the present phenomenal rise in the value of carriers recalled her to the mind of the public. A syndicate of Seattle shipping men bought the wreck for a very attractive figure ($35,000, it is said), and prepared to salve the ship.

In July, 1916, the wrecking tug "Pilot" left Victoria with a full salvage outfit. Arriving at Ocos, the wreckers found a rather disheartening prospect awaiting them. The "Sesostris" was lying broadside to the beach, in a basin too small to permit her being turned about. A barrier over a hundred feet wide lay between her and the highest point reached by the tide. To get the vessel afloat would necessitate her being moved 650 feet, as the shore at Ocos is very flat. The surf was pounding ceaselessly along the beach and the wrecking material was landed with great difficulty.

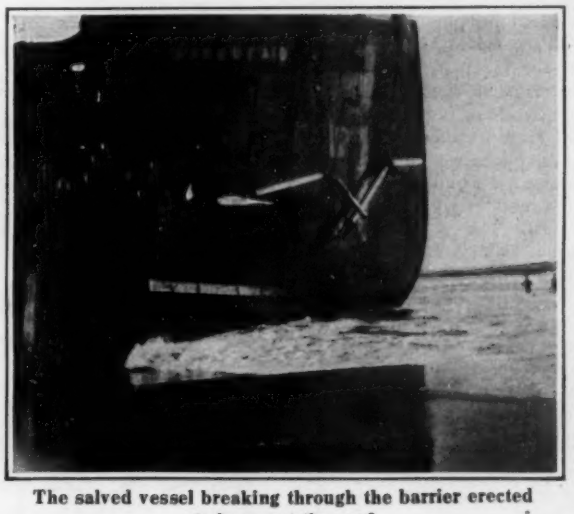
A dredge was assembled, in the form of a decked-over scow carrying two powerful suction-pumps connected up with the vessel's machinery. The lagoon was gradually enlarged, the sand being carried well out of the way by means of a system of pipes. At length the ship, 378 feet long, was warped about and her head turned toward the sea. Huge kedge anchors were planted to seaward and connected with the ship's winches by heavy cables. Then as the dredge sucked out a channel through the stretch of sand, the vessel laboriously pulled herself along the narrow water-way.



The dredge was operated from aboard the wrecked ship, the sand being discharged through the pipe shown here



The bow of the "Sesostris," showing the suction pipes of the dredge



The salved vessel breaking through the barrier erected to keep out the surf

Success assured—the "Sesostris" entering the deep water, after passing safely through the surf

When the barrier was cut through, the problem became largely a tidal one. But little tidal data could be obtained, however, further than that the rise and fall of the tide was very small and insufficient to be of benefit to the wreckers excepting for about three days each month. It was necessary to work continuously to hold the advantage gained between each set of tides. Extremely hot weather and an occasional earthquake added to the trials of the salvers.

When tide-water was reached, a new difficulty presented itself. The sand, kept constantly in commotion by the breakers, filled up the channel almost as fast as it could be excavated. To obviate this, an extensive breakwater of steel piling was driven, roughly triangular in shape, extending beyond the surf-line. The dredge too, became hard to manage in the swirling water, so a novel expedient was resorted to. Holes were cut in each side of the bow of the "Sesostris" herself, and through these the suction-pipes were extended and operated from the deck. The pumps were set up aboard the vessel and the sand was carried by the pipes through the vessel, up to the deck and discharged over the side.

On March 24th, 1917, after nearly nine months of constant toil, the "Sesostris" had been worked well out towards the breakwater. The high tide for which the wreckers had been waiting arrived and with it a very heavy sea. A few minutes delay now might prove fatal; so without waiting to remove the bulkhead, the vessel cut through it and continued on her way seaward. After a few hours more of intense anxiety on the part of the salvers, the steamship was riding free in deep water, after her long sojourn in the sandy wastes of Guatemala.

A survey of the vessel showed that she was not taking any water, and that the machinery, due to the attention it had received, was in excellent condition. Under her own steam the "Sesostris" started for Seattle, which was reached without incident about the middle of May. The salvage cost about $250,000. As the "Sesostris" will be worth in the neighborhood of a million dollars at ruling prices when repaired, the venture will prove a very profitable one.

While the "Sesostris" lay imbedded in the sands at Ocos, spacewriters invented a number of interesting items concerning the ship. One of these was to the effect that an engineer in charge of the vessel wired the town of Ocos and furnished light and power to the inhabitants from the ship's dynamos. The truth is that there are not half a dozen families there that would have the slightest use for electricity in any form. The stories of the vessel being used as a hotel, and as to how the craft was kept free of rats by tame snakes, while ingenious, also belong to the realm of pure fiction.

Serious Forest Fire in the Northwest

SEVERE drouth conditions in the Northwest have developed a forest fire situation so serious that the Forest Service is now spending, in Montana and northern Idaho, $10,000 a day for fire-fighting and increased patrol. One large fire on the Kootenai National Forest in the northwestern corner of Montana, has engaged 300 fire-fighters and another force of 100 men is contending with a large fire on the Flathead Forest, in the same state. Dangerous conditions are reported also from Washington and Oregon.

In much of the Northwest the Forest Service reports state that no rain has fallen for weeks. As a result the forests are bone-dry. High winds are prevalent and the situation is said to parallel that of 1910, when forest fires caused a heavy loss of property and life.

Practically similar conditions are indicated by reports from Washington and Oregon. In the latter State many fires have already occurred and in the Crater National Forest several are said to be developing seriously.

The regular organization of the Forest Service is being supplemented by additional patrolmen in order to meet the emergency.

Bread from Sugar Beets

SUCCESSFUL attempts to use the sugar beet in making bread have recently been made in France, according to *l'Agriculture Nouvelle*. The beets are boiled, then grated and mixed with an equal amount of wheat flour and the proper proportion of salt to form bread dough.

Strategic Moves of the War, September 13th, 1917

By Our Military Expert

INTEREST in the happenings of the Great War has centered on the recent German successes around Riga as much as in the remarkable Italian operations on the Gorizia front that have, however, not yet met the full promise of a few days ago.

The strong German push on the Riga front had been expected for some time and the demoralized condition of the Russian troops as a result of the recent revolution and some of its unfortunate consequences were too well known to their opponents to lead to the belief that much resistance could be expected when the blow fell. Minor operations around and to the west of the Great Tirul swamp south of Riga led to the belief that a flanking operation that would come out on the shores of the Gulf of Riga west of the town itself was in contemplation. It now turns out that these moves were a blind to hide the main drive which was made by forcing a crossing over the Dwina River at Uskull, 16 miles southeast of the town. The river was the main obstacle to the German advance; once forced, the railroad to Dvinsk that runs along the northern bank was easily cut; this road was the main supply line and its loss meant that Riga itself must be given up. This was done practically with no opposition and a hurried retreat of the Russians, mainly in the direction of the large town of Wenden to the northeast, was at once in order.

Although it is claimed that there were 150,000 men assembled in and around the Riga positions to defend the great bridgeheads on the west bank and along the Aa River, the effect of being outflanked by the German move required such a hasty evacuation of the town and of the outlying works that a large number of guns and quantities of war munitions fell into German hands. The retreating Russians were hotly pursued and at last accounts were still being attacked 50 miles east and north of the Livonian capital. Reports indicate, however, that some order is being brought out of the chaos of the disheartened and defeated troops. Efforts are evidently being made to establish lines to cover the retreat; but any substantial results can be expected only when the higher grounds of eastern Livonia are reached. The Aa Plateau, where the elevation reaches at least one thousand feet above the sea level, will give some hopes of averting the pursuit that has thus far been so vigorously and successfully pushed.

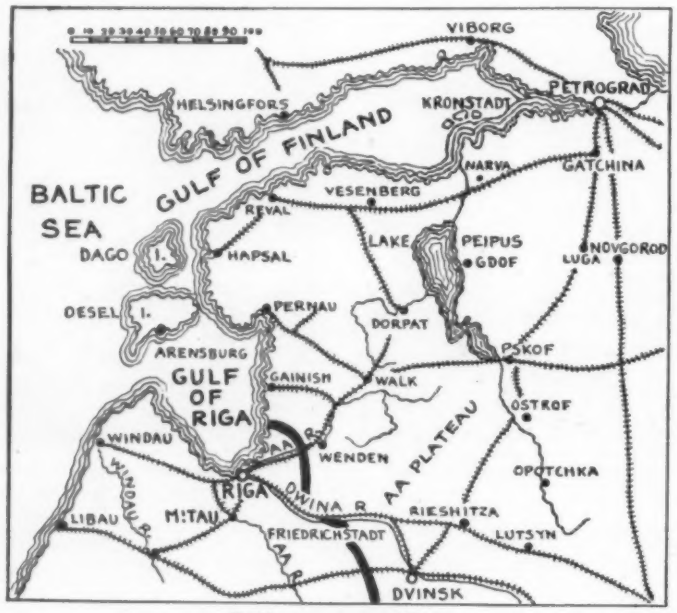
Much has been said of a possible advance on Petrograd as if this were an easy matter to accomplish. All of the western half of the Baltic province is low land, almost a bog, and interspersed with numberless lakes. From Riga to Petrograd is 350 miles and it cannot be believed that the German commanders contemplate at present any such extended land operation. The fall rains will soon begin, rendering the country practically impassable for armies with their heavy impedimenta. It is therefore not very likely that any such land movement can be seriously thought of with a Russian winter at hand. All that may possibly be attempted will be to get around the Russian right flank that is now in the air. As to the results in a military point of view of the occupation of Riga, it would be best to look not northeast to Petrograd but southeast to Dvinsk, a city that the Germans can probably take at any time. With that important place in their possession, the possibility of breaking through the entire Russian line along the Dwina and carrying such a move as far as Minsk or beyond can be expected. In the present condition of the Russian army such a move is well within probability, with every prospect of success.

The latest information shows that while the Germans are extending their left wing along the shores of the Gulf of Riga, all the moves along the Dwina in the direction of Romershof, Friedrichstadt and Jacobstadt indicate a massing of troops for a stroke at Dvinsk (Dunaberg). As stated, if this important fortress shares the fate of Riga, as seems highly probable, a great part of the Russian western front would collapse. The Germans are now bridging the Aa north of Riga in the direction of Wenden and also near its mouth on the Gulf. If a strong force aided by the German navy could force its way north, it could approach and even reach Reval, one of Russia's naval strongholds on the Gulf of Finland. But such a move would not be attempted before reducing the fortress of Dvinsk on the army's right flank; the latter is the pivot on which the Russian line swings across the river to the south and is strongly held and garrisoned. As the line crosses the river here, the greater part of the Russian forces are on the left bank and on a front of many miles; the troops are said to be in a better state of morale than at any other point and strong resistance to a German advance can be expected.

The fall of Riga was for the Russians a grave military disaster; but the reason for its fall is of far greater importance as showing the disintegration taking place in the Russian ranks. Here is a seaport second only to Petrograd and Odessa in importance; yet it is given up almost without striking a blow. It is the same spirit that led to the shameful retreat of the Russian armies in Galicia—the unwillingness of the soldier in the ranks to face the foe. It is entirely contrary to the national character of the Russian soldier, who is a born fighter of the most determined tenacity.

This failure of the morale of the army, this unexpected disintegration of the military spirit and obedience, is a grave peril not only for Russia and its present government but also for all of Russia's allies. And it will need all the latter's support and herculean efforts if Russia is to remain as a republic. The present invasion of the Germans in the direction of Petrograd is doubtless more a politicial move for home consumption than for any ultimate military results. But it has shown once more the cancer eating into Russia's military strength that may be averted or cured only when too late, as civil war now seems so imminent.

Riga's fall cannot be laid to any unusual powers of Germany's forces for it has been well known for some time that the city could be taken whenever it was desired. Any extension of the German lines on the eastern front at the present time is however a distinct disadvantage in a military point of view. Not only are more troops required to hold advances made—something not easily supplied with Germany's dwindling man-power—but the great questions of transportation and supplies will become the more serious. And the nearer the Germans approach Petrograd, the greater will their difficulties become, especially with a Russian winter to face for months. Riga had to be taken for political reasons both in Russia and at home and not for any military advantages to be reaped from its possession.



Battle area around Riga

The country north of the Dwina in which the troops must operate for an advance offers but little in the way of agriculture and therefore in the way of supplies; the only advantage of an invasion will be its effect on the Russian people to cause them to sue for peace. It would have little influence on the war in general for so long as Russia keeps armed forces in the field, just so long must Germany and her allies be prepared to meet them. The war will be finally determined by success or failure on the western front.

A prominent Russian general stated recently that the danger point was not here at Riga but on the Rumanian border. For Germany needs grain, meat, oils and other necessaries of life; these will be found, not in the relatively unproductive country of the north, but in the rich plains of Bessarabia and in the Black Sea grain belt. Here will be the reward of all her struggles if once a free rein can be given to a forward movement over the Sereth, the Pruth and Dneister and on to Odessa. Such an outlook is well within the range of possibilities if the present demoralization of and dissatisfaction in the Russian armies are to continue.

The Italian advance, so fortunately begun some days ago by the capture of Monte Santo above Gorizia and of parts of the Bainsizza Plateau, has been held up for some time by the desperate resistance of the Austrians on Monte San Gabriele which, though on a lower elevation than Monte Santo, has stood like a dike to hold back the Italian troops and to connect the Tolmino lines with those on the Carso to the sea. This mountain could no doubt be taken by tremendous sacrifices of life on the part of the Italians, but so far as the mountain itself is concerned, it must in the end fall from the plunging artillery fire from Monte Santo, though this delay gives time for the Austrians to consolidate new lines farther to the rear. Severe storms are reported as having materially interfered with offensive operations on this front.

General Cadorna is evidently striking in two directions—north and south—toward Triest and in the direction of Laibach, 45 miles away "toward Vienna" if distance is not considered. He is gradually getting possession of the Bainsizza Plateau; once he holds this, the Chiapovano valley at its foot will enable him to separate the two wings of the Austrian army and leave their flanks in the air. He could then turn on either or both and crush them at will. But just now his object appears to be not towns nor positions but the Austrian army; he is endeavoring to destroy its effectiveness as a military force; if its lines can be broken and its two wings defeated, then an advance on Vienna becomes a possibility—not before, however. Triest at present would appear to be a secondary consideration though its fall would be a shock that would be felt throughout the Austrian Empire. It is an invasion of Austria after the rout of its armies that the Italian General Staff has evidently had in mind.

On the western front there have been the usual isolated actions that have brought no wide, definite results. There has been violent fighting on the right bank of the Meuse north of Verdun in which the French have made some progress in the direction of Ornes and Beaumont. On the left bank of the river there have been similar indications of pending attacks with no great amount of infantry fighting. It may be said that any advance by the French from and along the Meuse River would have exactly the same effect on the Verdun situation in France as reoccupation of the Belgian coast by the British troops. An evacuation of all France west of the Meuse would be forced and the war would be split into two campaigns—the Belgian, French and British in Belgium and the French along the Meuse. Just now it is possible the French commander has no such objects in view. He is apparently working not to break through but to prepare a number of places where moves can be started next year when our own troops have arrived and when the Germans are strained to the utmost. Everything shows that the latter are on the defensive on the western front and have all they can do to hold their own against their opponents.

In Flanders, on the Somme, and on the lines of Hindenburg's retreat, the pressure of General Haig's troops is becoming more pronounced, there has been lively fighting at many points but nothing that has developed into movements on a large scale. As on the Italian front, heavy storms have prevented any marked forward movements or even any battles on a large scale. Interest has heretofore largely centered in the attempts to capture Lens; even if taken, the results would not be so great as would have been the case in the spring when the British troops might have turned the north end of the Drocourt-Quéant switch line; it is, however, a place of great importance and its recapture by the British without too great loss of men would be a heavy blow to German prestige.

As regards the struggles around Ypres, they can be regarded like the French situation—around Verdun—as a preliminary to something more important to come. In reality, it is a fight for the Belgian coast to restore the situation before Antwerp was taken by the Germans. As a whole, the present operations on the western front merely prepare the way for next year's campaign in order to bring the war to a close. The victory will be for the side that knows best how to conserve its men and material and thus to bring at the supreme moment to the battle front the maximum of physical strength.

It is interesting to observe the manner in which the work of the present Allied campaign is now being carried out. It will be noted that there is a general assault from all sides, at present without counting on Russian assistance. And whenever these assaults have been made, the Central Allies have given way The most brilliant advance is probably that on the Italian front where not only the greatest natural obstacles are being overcome but the fruits of a well-thought-out, well-organized campaign are now being gathered without any serious hitch or defeat being suffered. The capture of Gorizia last year gave the starting point for the present year's

(Concluded on page 219)

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Paper Milk Bottle

To the Editor of the SCIENTIFIC AMERICAN:

I notice in the September 1st issue of your paper an article under the heading of "Glass vs. Paper Milk Bottles" in which the writer claims that they are more sanitary than the paper containers.

I am somewhat familiar with the methods of handling milk bottles in the dairy and from my observations, I would prefer the paper container if they can be packed and handled like the paper drinking cups of today.

In the dairy you will find a washing tank over which they have mechanically operated brushes for washing the inside of the glass bottle and this brush in itself is far from sanitary, at least ones which I have seen in operation.

After the bottles are washed they are put into cases and stacked in the corner where the water bugs are plentiful around the damp walls, and removed from there to the filling table at night by the watchman as part of his night's work and with very poor light.

It was only last week that my wife noticed dark specks in the bottle of milk when it arrived in the morning and she strained it through cheese cloth to find a cockroach with its legs and other parts separately floating around.

She has since received apologies from the milk dealer's dairy where it was returned.

I know nothing of paper containers or how they are made but if perfected I can see how they may be removed from clean packing cartons and filled without going through the so-called sanitary washing machines commonly used in the most modern dairy.

J. H.

New York.

Submersible Merchant Ships

To the Editor of the SCIENTIFIC AMERICAN:

I think your idea of publishing a series of articles giving detailed drawings of submarines and torpedoes and description of the method of operation, etc., is an excellent idea. Almost everyone having anything to do with submarine construction is being overwhelmed with impracticable suggestions as to "how to catch the submarine." It reminds me very much of the old poem of the Frenchman and the flea powder, in which the Frenchman, by his persuasive eloquence sold a lot of brick dust in a certain town as flea powder, which was to exterminate all the fleas in the town. Unfortunately for him, he forgot that he had once visited the town and returned there a year or so later, when the citizens captured him and held an indignation meeting. But the Frenchman was equal to the occasion. He asked them how they had used the flea powder and they said they had dusted it around their rooms, but the fleas remained just the same. To which, the Frenchman replied: "You did not use it right. You must first catch ze flea, zen open his mouth and poke the powder down his throat, and ze flea will then choke to death."

Every day I receive numerous schemes for locating or destroying submarines. Most of these people do not realize the fact that any means which a surface ship can use for the detection of submarines can also be used by the submarine for detecting surface ships and that the advantage will always remain with the submarine as long as the submarine has the capacity to remain invisible, which the surface ship has not. With that handicap there can be only one end, provided Germany can hold her own frontier on the land—and that is, the gradual depletion and ultimate destruction of all surface ships which approach the English coast, *as no fabric can be made to float on the surface of the seas and withstand the explosive force of a mine or torpedo when such mine or torpedo is exploded beneath the hull of such floating fabric.*

The possibilities of the military submarine have not yet been realized. In my judgment, there is only one way to counteract this submarine menace to the commerce of the world, and that is by cargo-carrying submarines, which may, themselves, take on the mantle of invisibility at will. These ships must, also, be noiseless in their operation.

As you are aware, I have been advocating the construction of cargo-carrying submarines for a long time, and the Germans eventually proved its practibility by the four trips which the "Deutschland" made through the patrolled waters of the North Sea.

I do not say that it is impossible to provide some means of detecting and destroying submarines beneath the sea, but I do not know of any practicable suggestion that has so far been made. You may remember that at the beginning of the war the SCIENTIFIC AMERICAN published an article by me showing how submarines could pass over or under nets and through mine fields with impunity. I am, I believe, familiar with most of the later devices that have been proposed for the extermination of the submarine, and were they not taken seriously by the public I would not consider them worthy of mention, but because of the fact that they are taken seriously, our people are being led to hope where there is no hope, and we are living in a "Fool's Paradise." In the meantime our Allies are being bled to death and we are preparing to spend billions of treasure and lose the lives of probably millions of our young men in prosecuting a long war which would, in all probability come to a speedy end if the Germans saw that their purpose to prevent commerce could be defeated. Why cannot the authorities see this very plain fact, that it is not good business to spend $1,000,000 building a surface ship and load her with $2,000,000 worth of cargo and then send her to sea to be lost. Whereas, they can build a cargo-carrying submersible for one-million-and-a-quarter dollars, load her with 5,000 tons of cargo and send her to sea immune from the perils to which the surface ship is exposed, she can deliver her cargo to our Allies and return for other loads. The point is this: the surface ship costs a quarter-million dollars less and is lost, together with the lives of the crew and the much needed supplies, whereas the submersible cargo-carrier not only delivers the supplies, but is available for other trips.

I must admit that I am almost discouraged at the lack of ability of the "powers that be" to read the "writing on the wall," which should be as plain as A, B, C. And that is, that until some means are provided to see through the waters of the ocean with substantially the same clearness of vision as may be done through the air, the surface ship is bound to be handicapped in the most important particular and, consequently, victory will remain with the invisible destroyer.

My intelligence is incapable of finding a logical reasoning for the press of the country, or those who control the press of the country, in constantly trying to belittle the success of the submarine. This morning I see, in great headlines, *"ONLY 700,000 tons of shipping destroyed by submarines during the month of May"* Just think of it! Trying to belittle the fact that 700,000 tons of shipping had been lost in one month. Perhaps our people would have been awakened if the headlines had said, *"700,000 tons of shipping lost during the month of May, more than the total shipping of the United States engaged in ocean trade."*

What are we going to do about it? The terrible fact remains, that the surface shipping of the world is being depleted faster than we can possibly replace it. And even if we could build as fast as it is being destroyed, why send all this wealth in ships and cargoes to the bottom of the sea, where most of it can never be recovered. Cannot our Allies and our own people see that if this war continues much longer the only shipping of importance that will remain will be the German shipping, which is being protected by their line of submarine defense.

Cargo-carrying submarines can be built which will give protection to crews, cargoes and ships and the cost will not be over 25 per cent more for dead-weight carrying capacity than the vulnerable surface ships; yet we "muddle along," risking the lives of our citizens and the national existence of our Allies.

SIMON LAKE.

To Make Nets Stay Down

To the Editor of the SCIENTIFIC AMERICAN:

In your August 4th issue, in correspondence column, your reply to J. H. Arnold regarding nets to protect merchant ships, you say nets would be carried to the surface at high speeds.

I feel a very simple device could be made to hold the nets down, viz.: Attach to lower lead corner of net, by second tow line, a block of wood with a flat iron upright keel and with side wings attached that would cause the device to sink deeper as the speed would increase, on the same principal as a flying kite.

I have tried this with small model and find it will work.

Pasadena, Cal. C. B. C.

Insurance, or Prevention

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of July 14th, you call attention to "Fire prevention as a War Measure."

I believe that fire insurance as at present conducted is wrong, and is in a measure responsible for our enormous fire loss. Under the present system the insured is protected against any loss, no matter how trivial, even if caused by his own carelessness. This is dead wrong, and encourages carelessness and dishonesty.

The insured should be made to bear the first loss up to say 5 or 10 per cent of the amount of the policy, while the insurance company should pay any loss in excess of this up to the face of the policy. This would make the insured more careful to guard against fires and at the same time would insure him against excessive loss. It would tend to prevent over-insurance, as the larger the policy the greater loss the insured would bear. It would save the insurance companies the expense of adjusting many small losses, and would enable them to make lower rates.

In the long run it makes little difference with the insurance companies what the losses are.

If they are excessive they raise the rates and distribute the loss among the insured. It is a notorious fact that many disastrous fires are caused by the carelessness or dishonesty of the insured, and any system that would check this deserves consideration, even if it reduces the income of the insurance companies.

H. N. ROBINSON

Hartford, Conn.

Beating the Smoke Screen

To the Editor of the SCIENTIFIC AMERICAN:

A method of photographing artillery positions and other important points, that are masked by smoke screens as announced by dispatches from the front, is available.

If aviators will use infra-red and ultra-violet lenses or screens, they will be able to photograph the correct positions in spite of the new German smoke screen.

DR. L. K. HIRSHBERG.

Baltimore Md.

That North Sea Net

To the Editor of the SCIENTIFIC AMERICAN:

All honor to the SCIENTIFIC AMERICAN for suggesting "the only effective means of meeting and defeating the German submarine campaign." Of course it can be done. Always it is the "impossible" which such men as Roebling, Goethals, Grant and Dewey accomplish. Can't we have an "allied drive" of people and periodicals of influence until the authorities take notice?

The more cargo ships built and commissioned the quicker will Germany conquer the world unless the submarines are defeated. It is the loss of labor and food which appalls.

ELMER F. GOULD, M.D.

Boston.

An Unsinkable Cargo Ship

To the Editor of the SCIENTIFIC AMERICAN:

Looking at cross-section of the German U-Boat, page 572, it seems that if the sides could be made more perpendicular so as to give greater distance between outer and inner hull at bottom as protection to inner hull, and the outer hull could be divided by air-tight bulkheads into compartments 10 feet or more in length which would be entered only by a hatch on deck closed like a man-hole in a boiler, we would have a nearly unsinkable ship for grain carrying that could run just above the surface and not need any submerging.

The center hull might for safety be considerably above the bottom of the outer hull. And if the boat was well-armed and driven by two sets of oil engines, with electric drive to two screws, at both bow and stern, it would be difficult for a submarine to put the boat out of commission. The thought being that by electric drive the engines could be higher up and farther from danger, and by the four screws, if one of the shafts was bent by torpedo, the others could still be used.

Further, while I have great admiration and all respect for General Goethals, I cannot help but think that if he had kept pace with what the Pacific Coast lumbermen have been doing in the way of wooden ships, with Auxiliary Diesel Engines, he would want wooden as well as metal ships.

From past observation, in other kinds of work, would ordinarily expect the wooden ship to be built and loaded and through the Canal on the way to "Somewhere in France," before the detail drawings for the outside plates for one metal ship could be made.

J. H. S.

Dayton, O.

A Machine Shot Gun

To the Editor of the SCIENTIFIC AMERICAN:

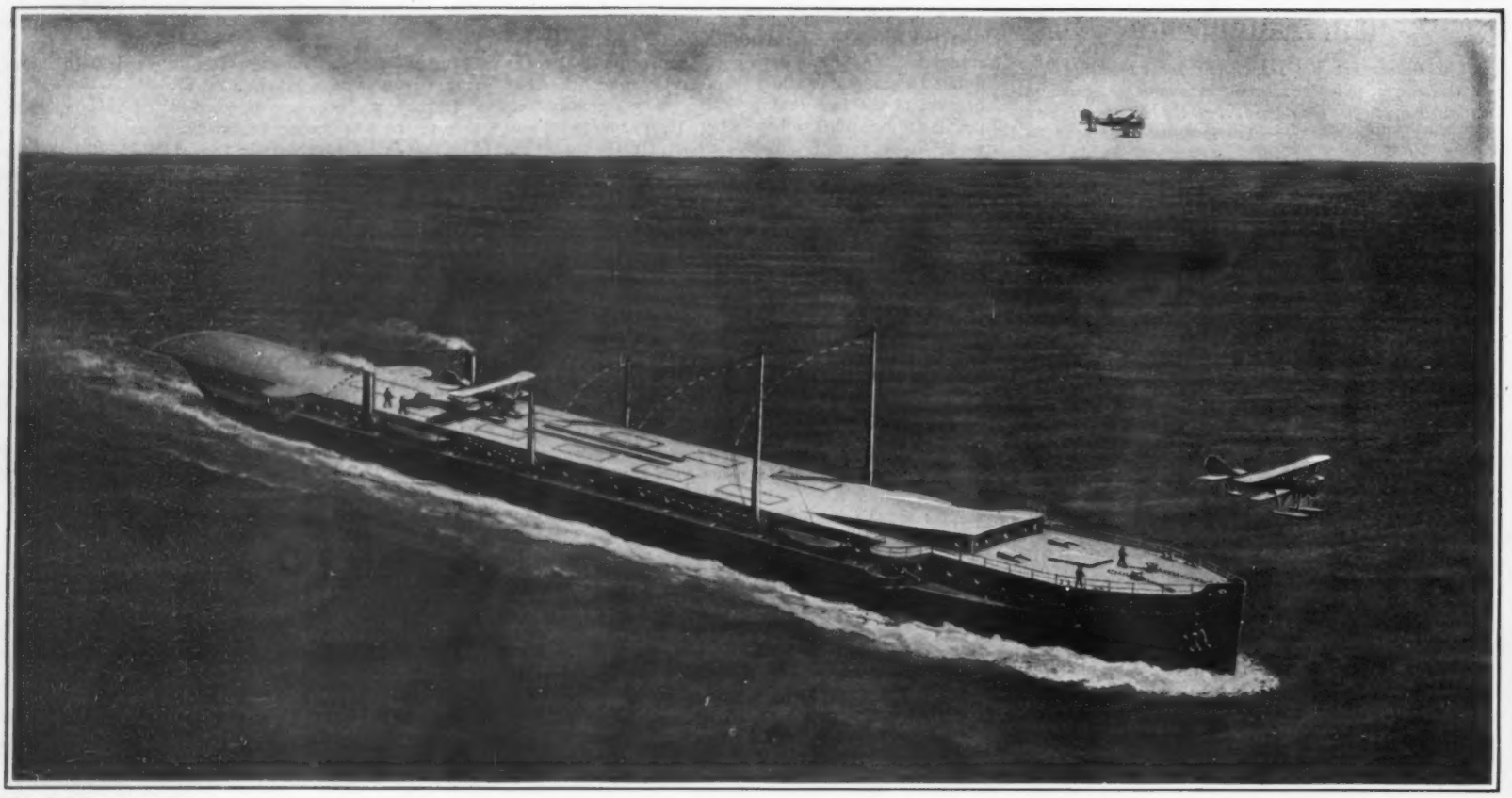
I noted in particular the contents of one of the letters contributed to your magazine, because it related to a subject upon which I have laid claim to an original idea which I think goes the author, Mr. J. L. Travis, one better by way of suggestion.

He proposes that our soldiers be supplied with magazine shotguns for use at close quarters with the enemy. In my opinion, the best kind of shot-gun for them to use is a machine shot-gun, which, by the by, has not yet been produced, and there should be one for about every ten soldiers. Confronted by a line of such guns during a charge, the enemy's troops would be literally sprayed with lead, and I can't imagine how one man could escape being shot.

If anybody can offer a reason why such a gun could not be made to work properly, or why its efficiency as a man-killer would not exceed that of any portable gun now being used, I should be very glad to know it.

JOHN KRUTTSCHNITT

San Francisco, Cal.



Displacement: 15,000 tons. *Speed:* 16 knots. *Protection:* a wall 15 ft. wide by 50 ft. high, minutely subdivided, on each side of the ship. *Armament* four 51-caliber 5-inch guns; three bomb-dropping aeroplanes

AN IDEAL MERCHANT SHIP FOR THE SUBMARINE ZONE

The Submarine Problem—XV.

The Merchantship as a Submarine Destroyer

THE decision of the British Government, some two years ago, to arm merchant ships with anti-submarine guns produced positive consternation at the German Admiralty. Up to that time the sinking of unarmed ships had been done with positively no risk to the submarine; but if, from now on, these frail craft upon emerging were to be subjected to rapid gun-fire from the steady platform and lofty decks of the merchantship, the difficulties and dangers of submarine attack would be enormously multiplied.

According to German psychology the only lawful attitude for a British skipper, when attacked, was one of lamb-like submission; for him to defend himself would be a crime so heinous that it must be punished by death.

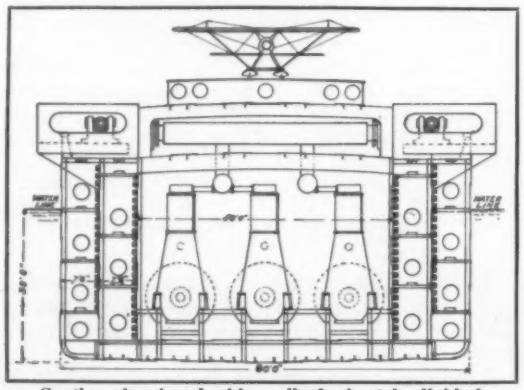
Hence, the unspeakable crime of the murder of Captain Fryatt.

The gun was the obvious answer to the submarine, and the mounting of batteries on merchantships has greatly decreased the losses among ships that have been attacked.

Another obvious way to protect the merchantship is to make it unsinkable, or, if not unsinkable, at least as far unsinkable as the conditions of the problem will allow. This is one of the most important questions relating to the type of ship which we shall build under the present emergency appropriation; and we understand that the Navy Department intends to incorporate a system of compartmental sub-division, corresponding broadly to the construction which has proved so effective in war vessels.

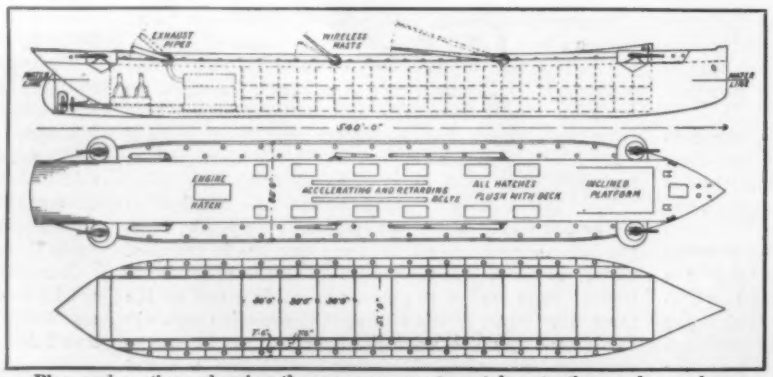
There is a third defensive measure, the use of which is being very widely agitated and has indeed been successfully applied, we understand, upon a few merchantships. We refer to the use of aeroplane scouts which, as every one knows, are wonderfully efficient in covering a considerable area of the ocean and detecting an enemy that would be invisible from the deck, or even from the masthead, of a ship.

In the present chapter of our submarine series we present a study of the problem in which the author, John L. Bogert, has incorporated all three measures of defense and attack in a single freight-carrying merchantship of about 15,000 tons. As will be seen from the drawings, this vessel mounts four rifles, preferably of not less than 5-inch caliber, in sponsons, each gun having a wide arc of fire. The ship is provided—on each side—with a double wall of anti-torpedo compartments; and she is so constructed as to afford a wide and lengthy landing platform for aeroplanes on her top deck, provision being made on this ship for three large and swift machines. The armament is well placed and sufficiently powerful to give ample protection. The mounting of the guns in sponsons gives an all-round concentration of fire of at least two guns, which is secured without interfering with the starting and landing of the aeroplanes. The least powerful gun that should be employed is our 51-caliber, 5-inch naval gun—a most excellent piece of great power and long range. If our gun-building



Section showing double wall of minutely-divided compartments, 15 ft. wide by 50 ft. high

capacity can be sufficiently developed to permit of it, no ship of the great fleet which we are constructing, should carry a gun of less power than this. The 4-inch gun is not sufficient. The later German U-boats carry a 4-inch piece, and the presumption is that they will go up to their favorite 5.9 gun in the larger boats which they are now building.



Plan and sections showing the guns, compartmental protection, and aeroplane-launching platform of proposed merchantship

The Bogert ship calls for the construction on each side of a double wall of anti-torpedo compartments. The compartments are 7 feet 6 inches wide by 10 feet deep and 30 feet in length. Each is provided with manholes which, when the ship is ready for sea, are closed by watertight covers. It is the intention to use these compartments for the storage of special kinds of cargo, which would be resistant to the torpedo and would act with a water-excluding effect in case of injury. It will be noted that, with a view to preventing flying fragments of the outer shell of the ship from being carried through the inner walls, the latter are lined with heavy timbers, laid longitudinally. There can be no denying that this system of sub-division, providing on each side of the ship a minutely sub-divided protective wall, 15 feet wide by 50 feet high, would enable the ship to take the blow of any but the very largest torpedoes without necessarily being sent to the bottom. She would, at least, have a good fighting chance of being brought home under convoy, repaired in dry dock, and sent once more into service.

It is a shameful fact, as we have already noted in these columns, that shipping men are so utterly devoid of patriotic impulse, that they are unwilling to incorporate anti-torpedo construction in the hulls of their ships because it will reduce the freight-carrying capacity, and therefore render them less profitable when the war is over. In other words, they are thinking more of winning dividends than they are of winning the war. Fortunately, the question of what type of ships shall be built in the future is now in the hands of the Government, and we may trust our naval constructors to see to it that our new freight ships are thoroughly protected.

Although this vessel is a merchant ship of large freight-carrying capacity, it is also a well equipped aeroplane tender; for provision is made for the carrying permanently of three large-size, bombing hydro-aeroplanes. To provide a landing platform, the exhaust stacks of the oil engines, the masts for the wireless, the derricks and gear, etc., are so arranged that they can be folded down to give a clear platform. To compensate for the rolling of the ship and provide a fairly level surface for the aeroplane to land upon, the deck is heavily crowned. To assist in the takeoff when the aeroplanes are starting, the deck at its forward end is inclined upwardly, passing over the roof of the pilot house. The planes are provided with pontoons for landing on the sea, and, housed within the pontoons, are the usual landing wheels of the aeroplanes, the bottom of the wheels projecting sufficiently to keep the surface of the pontoons clear of the deck.

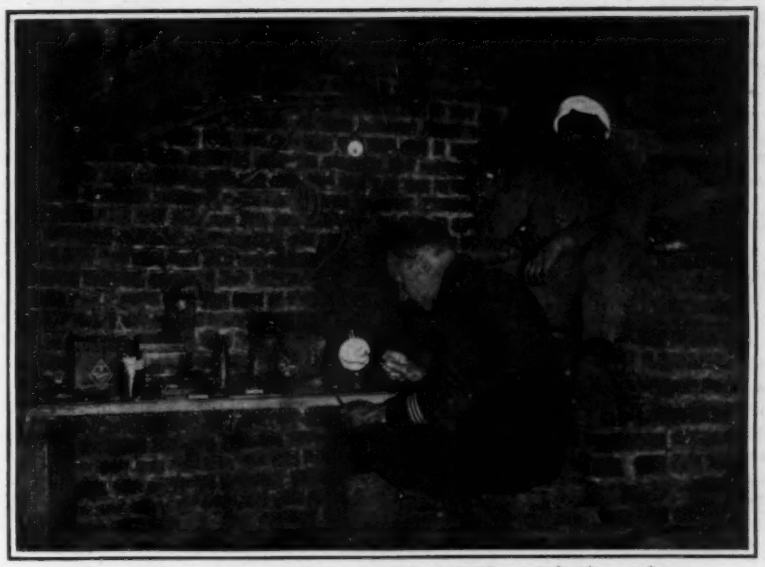
(Concluded on page 219)

The Absent Treatment in Efficiency Tests

Bringing the Nerves of the Battle Line into the Laboratory

By Jacques Boyer

EVER since the course of the war gave the French their first breathing spell, they have shown a peculiar aptitude for what they call psycho-physiological investigation—the building up of a series of tests, partly mental and partly physical, by means of which a candidate for aviation or ambulance driving or some other special work is made to reveal his ability to do that work, while still far from the scene of action, and without the formality of an actual trial. We have already given an account of the tests to which candidates for aeroplane work are subjected in order to demonstrate their fitness or unfitness, as the case may be. These tests, practically infallible, by which a medical examiner in an easy chair is able to state whether a man who has never seen an aeroplane will make a successful aviator, are no more remarkable than the tests for gunners and feeders which we propose to describe here.



Cave at the front in which many of the experiments in the testing of gunners were carried on

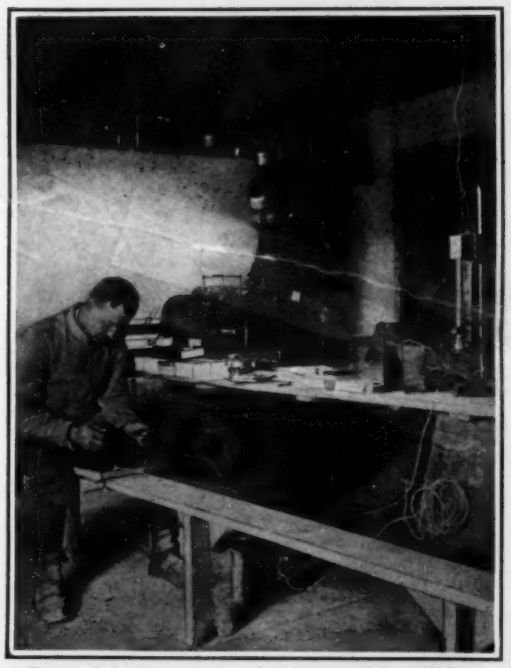
Perhaps in the bare statement that a prospective gunner can be tested as to fitness without going near a gun there is nothing more startling than in the analogous statement made with reference to a prospective aviator. But when we learn that all the experimental work preliminary to building up these tests was carried out by a young officer on the Somme front, during a period of great activity, in his spare moments and in a laboratory which he rigged up in an abandoned house, an hangar, a cave, or any other shelter which the exigencies of the moment afforded, we must give the palm here, at least in human interest.

The officer in question, J. M. Lahy by name, is a psycho-physiologist by profession. Accordingly nothing could keep him from observing and reflecting upon the movements which the gunners and feeders were forced to make in operating the St. Etienne machine gun—just recently superseded, but for the first 30 months of the war the standard French model. This gun is fed, not by the cartridge belts which we think of in connection with rapid fire, but rather by clips containing 24 shells each. These clips are hooked at each end, and it is the duty of the feeder to hook each clip into the preceding one, thus keeping a continuous supply of ammunition running through the gun. The gunner proper has to attend to the aiming and firing.

As a preliminary step, M. Lahy analyzed the movements of these two men, and the psycho-physiological elements characterizing them. The gunner sits upon the low seat attached to his weapon, body slightly bent, eye at the notch of the sight, hands on the trigger and controls. The process of aiming calls for muscular rigidity, which the scientist translates into terms of "functional adaptation." Firing begins by pressure on the trigger, and ceases by release of the trigger. These operations demand what the psychologist knows as "motor rapidity," or ability to make action follow stimulus with a minimum delay, and "absence of motor suggestibility," or ability to resist the impulse to duplicate the movements which he sees others make, or which are suggested to his mind through some other avenue. Control of firing altitude, effected by the left hand on a wheel, of the lateral direction of fire, effected by lateral movements of the breech with the right hand, and of the firing speed, regulated by rapid turning of the barrel, as well as reliability in passing from fixed fire to fan fire, which necessitates moving a lever with the right hand, are all of great importance. All involve motor rapidity, precision in small movements, dissociation of movements (an attempt at rotating the two hands simultaneously in opposite directions, *one* hand alone to be reversed at a word, will help the reader to appreciate what this means), and rapidity of decision.

Nor are these exacting demands confined to the gunner. The feeder must place each clip in exactly the correct position; he must time each insertion accurately, since delay or anticipation alike result in jamming of the gun. Less complex than those of the gunner, his movements must accordingly be no less regular and precise.

Most important of all is the motor rapidity. The gunner must not hang fire; the feeder must not fail to complete his cycle in two and a half seconds. To test this attribute, M. Lahy employs a newly designed chronoscope, electrically operated. The hand revolves about a dial divided into 100 spaces. The hub is an electro magnet, and a second magnet is set in the back of the instrument. When the current passes through both magnets, the hand remains fixed; when the circuit carrying the second magnet is broken, the hand rotates at known speed. An electrically operated tuning fork, giving 50 double vibrations per second, is equipped with an interrupter so that, at each oscillatory movement, a current of very brief duration passes into the magnet and checks the hand in its rotation.

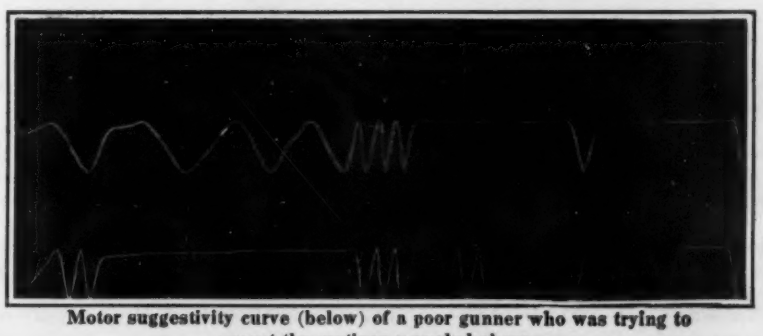


Determining how fast and how long the candidate can repeat a simple movement

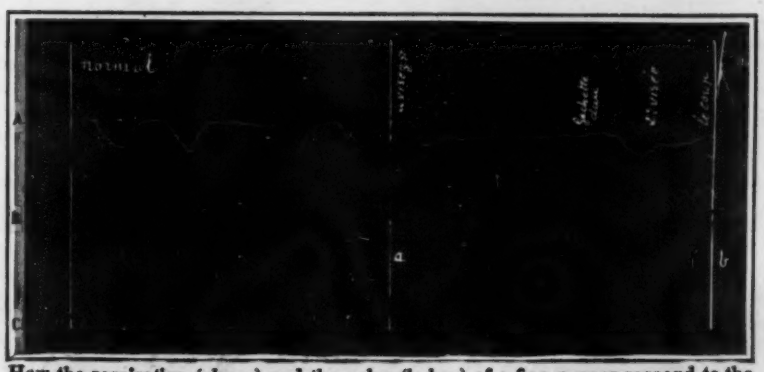
For measuring the time of auditory reactions, M. Lahy closed the tuning fork circuit in the traditional manner, by striking a hammer blow. In addition to its electrical effect, this blow was also the signal for the subject, who of course was blindfolded, to reopen the circuit by means of a switch held in his hand. The length of time which he required to do this was then measurable in terms of retardation of the clock hand. The timing of visual reactions, of course, required a somewhat different apparatus, involving a device for accompanying the making of the circuit with a flashlight signal to the subject. M. Lahy has at one time or another employed several means for doing this, none of which is in any way novel.

The figures obtained in the course of this investigation are very complimentary to the gunners involved. It appears that these men, acclimated to war by 18 months in a sector of great activity, possess motor speeds far beyond the normal. Thus, out of one squad of 20 men examined, the 13 best gunners showed an average visual reaction interval of .144 second and an average auditory reaction interval of .1157 second. For the seven poorest men the figures were respectively .2142 and .1884 second; the general mean for all 20 was .1686 and .1518 second. Even these general means are well below the classically recognized means of .195 and .15 second, respectively; and the best men throw these norms completely into the shade. Indeed, M. Lahy's findings have been severely attacked on this ground, but without very apparent justification. That the subjects of this test should be far above the average in this matter, to them one of life and death, is hardly surprising.

Be that as it may, our psychologist pursues his inquiry to study the rapidity of repetition of a given movement. The movement selected for this test was a light blow upon a copper plate with a small stilletto. Contact between stiletto and plate establishes the circuit and marks upon a recording cylinder each blow given. In this way not only the actual number of blows in an entire interval is recorded, but an index of fatigability is obtained by comparing the rates at which the stiletto fell during the beginning and during the end of the test. Given, then, identical indices of fatigue, the better feeder is the man with the greater motor speed. We are not informed as to the basis for comparison between candidates whose speeds and fatigabilities both differ; but the weight to be attached to each trait would be determined without serious difficulty.



Motor suggestivity curve (below) of a poor gunner who was trying to repeat the motions recorded above



How the respiration (above) and the pulse (below) of a fine gunner respond to the demands of action. The interval from a to b is that of extreme effort

An interesting part of the test is that relating to motor suggestibility, in which the standard Binet apparatus is used. Here it is found that the better men reproduce not only the starts and stops of movement communicated by the experimenter, but even the minor variations of speed; while the poorer "coffee-grinders," as mediocre gunners are termed by the poilu, are distinguished by a sort of motor hallucination, believing that they have felt impulses which were not given at all.

One item which required long thought on M. Lahy's part before he could reduce it to its symptoms was that of coolness under fire, or "sang-froid," as the French call it, cold-blood. He was finally reduced to experimentation. He recorded the variations of pulse and respiration of a subject

(*Concluded on page 220*)

Exploring the Skies for the Remains of Extinct Comets

Where Amateurs Can Render a Real Service to Professional Astronomers

By Charles P. Olivier, Adjunct Professor of Astronomy, University of Virginia

IT is generally believed that at the present time scientific work, to be of the least value, must be carried on by men of high technical training, making use of complicated and expensive apparatus. This would seem to apply especially to astronomy, since the modern well-equipped observatory is certainly the most costly example of a scientific laboratory.

However it is this oldest of all the sciences which still offers, in several of its branches, to the enthusiastic amateur, opportunities for original work of actual scientific value. For instance the observation of meteors, requiring as it does no apparatus of any sort except proper maps and blanks, is a field particularly suited to any person really interested in the science.

The American Meteor Society, which was founded in 1911, was designed to offer this very opportunity. To what extent it has succeeded can be shown by the following figures. In the interval 1911–1913, inclusive, 2,817 observations of meteors were reported by its members, in 1914–1915, this rose to about 5,500 observations, while finally in 1916 no less than 10,700 were reported to the headquarters of the society, which is now situated at the Leander McCormick Observatory of the University of Virginia. The observations of 1916 were made by 46 persons, working in 15 states and 4 Canadian provinces. When it is further stated that three-fourths of these observers are amateurs and that probably the 19,000 observations made in the last six years total more than all regular observations of meteors ever made in the history of America, the value of this contribution to the science can be better appreciated.

From the mass of data, as yet only partially worked up, much light has been thrown on a number of problems in meteoric astronomy which await solution. Many of these results are of a technical nature and of little interest to the general reader, but one of exceptional importance will be described.

Late in May and early in June of 1916, two of our observers, Mr. John Koep and Mr. Philip Trudelle, of Chippewa Falls, Wis., sent in maps which on being worked up showed at a glance there was something of exceptional interest in the observations. In other words, on both sets of maps, for a number of successive nights, radiants were found, so arranged in order that there could be no doubt they referred to the same meteor stream. Parabolic orbits were promptly calculated which all turned out to be similar. This means that the meteors seen on each night from May 19th to June 4th were, before their meeting with the earth, moving in paths in space almost parallel to one another, and hence belonged to the same system and no doubt had a common origin. The tables of comet orbits were searched and it was seen that the orbit of Pons-Winnecke's Comet, a rather faint member of Jupiter's family of comets, with a period of 5.89 years, and which has a most interesting history, was very similar.

The next step consisted in calculating elliptical orbits for the meteors, assuming they had the same major-axis as the comet. The agreement between the meteor orbits and the comet's was now so much closer that no possible doubt could remain and the discovery was announced as is usual in such cases in a Harvard Observatory Bulletin in August, 1916. Observations in Europe made later fully confirmed the result.

Since in a short article appearing in the Astronomical Column of the SCIENTIFIC AMERICAN for February 10, 1917, the statement was made that the connection between these meteors and Pons-Winnecke's Comet was discovered by Mr. W. F. Denning of Bristol, England, and thus entirely ignoring the priority of the American observations, it is considered proper to give all the facts in the case.

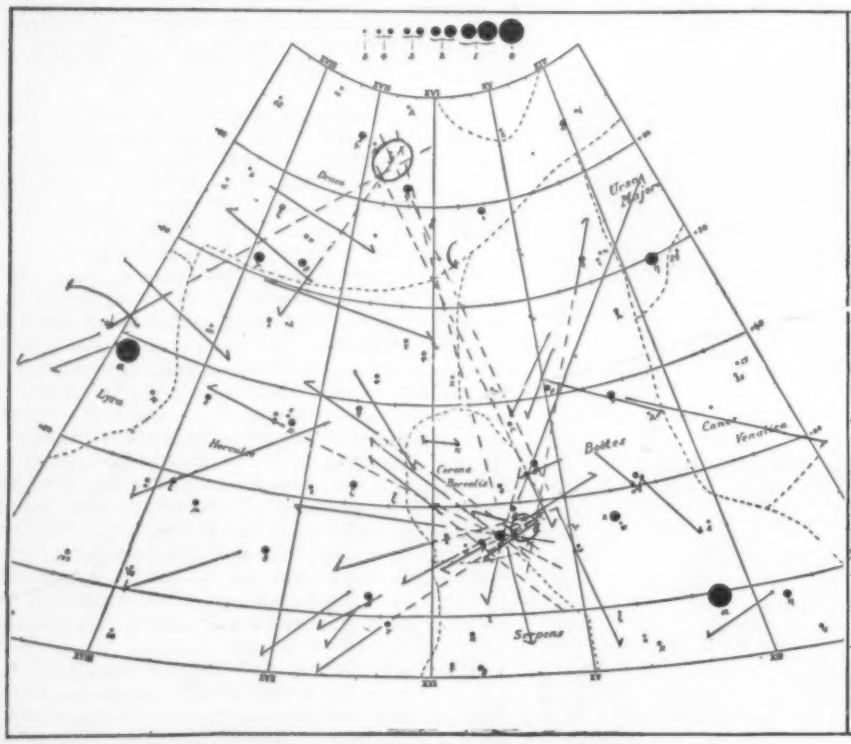
The first meteors of this system were observed by Mr. Koep on May 19th. He saw others on May 23d. Mr. Trudelle plotted a larger number of May 26th, and both of these observers continued to secure excellent observations of these meteors until June 4th, when their activity temporarily seems to have ceased. The maps were received here by June 10th, and several were at once worked up. Within a week of that date the discovery of the connection had been made by the author and mentioned verbally to members of our staff. Since the meteors seemed to have ceased coming there appeared no necessity for immediate publication, especially as it was desired to work out elliptical orbits, as well as parabolic, and read the whole as a paper before the American Astronomical Society at its August meeting at Swarthmore College, Pa. However, late in July a copy of *Nature* came from England giving a new and distant radiant, based on a bright shower of meteors seen on June 28th by an observer at Birmingham and also Mr. Denning at Bristol. At once an orbit was calculated for the Birmingham position—Denning's not being given in that paper—and since it exactly matched the earlier American ones, the whole was announced in Harvard Observatory Bulletin No. 614 on August 3d. Not until this had been sent out was the author aware of Mr. Denning's independent conclusion. It should be added that in six articles, in five different publications, written by Mr. Denning on the subject, which have come to hand here, in no one of them has he given any elements for the meteor stream nor published any mathematical proof whatever. Indeeed in one of these articles describing the shower not one word is said about Pons-Winnecke's Comet, and in the others his opinions vary very considerably as to the probability or certainty of the connection.

The complete mathematical proof of the connection, with all details, has been published by the author in *The Monthly Notices of the Royal Astronomical Society* for November, 1916, and with less detail in American journals, having meantime been read before the American Astronomical Society on August 30th, 1916.

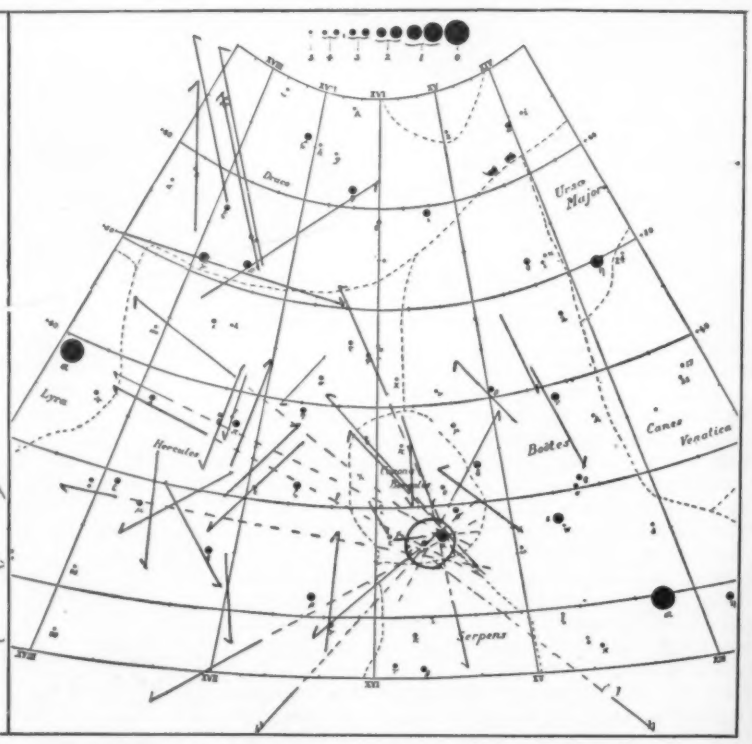
The reports on which this discovery was based were made by American observers who had only begun working on meteors some six months previously, and this shows how much skill can be acquired by an intelligent, industrious amateur in a relatively short time.

It being of importance for the growth and success of this work that other members be obtained, the following brief outline of the plan of observations is given. On any clear, moonless night choose a spot commanding a good view of at least half the sky. If possible avoid the glare of city lights and vicinities where smoke or fog are troublesome. Arrange on a table or box the maps and blanks to be used. Have a watch, ruler, some pencils and a light of some kind at hand. A flash-light, covered if necessary with paper or cloth to cut down its brilliancy, is recommended, though an oil lantern will do very well. Having filled in the places at the top of the blank for the date, place, hour of beginning work and state of the atmosphere, the observer concentrates his attention upon a certain section of the sky, preferably at least half way to the zenith. But every person before he starts regular observing should learn the principal stars, and how to use the maps so that any star can be readily identified upon them. The moment a meteor is seen the observer fixes in his mind its path with reference to the stars near it, holding up a ruler parallel to its path to help fix the direction accurately. He then draws upon the map an arrow, with the point in the direction of the meteor's motion and its length equal to the number of degrees the meteor traversed. The position of this plot upon the map is fixed of course by the stars he used as reference points to determine the meteor's path in the sky. By the side of this arrow is placed a number, which if it is the first meteor seen that night is 1, if the second 2, etc. Then on the blank he records this number in the proper column and in successive ones the hour and minute the meteor appeared, its magnitude, and other items of interest. Each column on the blank has its proper designation printed at the top, so there is no chance for a mistake. An experienced observer can make the full record, including the plotting of the path, in from forty to sixty seconds. The maps and blanks, ready for immediate use, are furnished free to all working members on application. One set will be sent to any new applicant for 10 cents to cover postage. If he uses these to advantage, he will be considered a working member.

To be of real use observations must cover at least one hour of continuous work. But several hours in succession are much more desirable. Each night's work being wholly independent, a person who can observe only once per month, for example, would be most welcome, though the oftener one observes the better. Full credit is given every member for the work sent in, both in brief annual reports and bulletins, and then in the larger complete memoirs which contain the results. To all, therefore, who are seriously interested a most cordial invitation to join in the work of the American Meteor Society is extended. On application to the author, the proper maps, blanks and instructions will be furnished, and any questions and difficulties which arise in the work will receive prompt attention.



Meteors observed by Philip Trudelle, May 26th, 1916

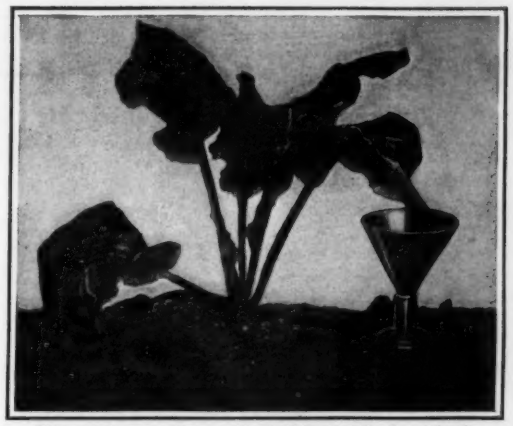


Meteors observed by John Koep, June 2d, 3d, and 4th, 1916

The Value of Dew

GARDENERS have, for long, been familiar with the large amount of moisture that condenses on smooth surfaces when the dew is falling. Some interesting experiments have recently been carried out to collect some of the moisture from the foliage of plants. A large beet-root plant was selected and, underneath one of the leaves, just where it bends down towards the soil, a receptacle was placed. The vessel which was sunk down into the ground was formed of a glass bottle and a funnel as can be seen from the accompanying illustration. As the water dripped from the leaf it fell into the bottle the narrow neck ensuring that hardly any of the moisture was lost through evaporation. The amount varied on different nights, but when the sky was clear, a surprising amount of moisture was collected in this way. It will be seen that the water was that which condensed on less than half the leaf.

Acting on the idea that dew is worth collecting an expert gardener has devised a novel plan for making the fullest possible use of this moisture. A piece of tin bent round in a half circle, as can be seen in the photograph, was painted so as to remove all fear of rust. This was tilted up in such a way that all the water that condensed on the surface would trickle down to the soil. Newly established plants were placed in furrows the trend of which was downwards, so that the water received as wide a distribution as possible. In this way three or four lettuces, for instances, were kept watered by means of one dew collector. The results were astonishing for, during a long spell of dry weather, the plants grew amazingly. Would not these dew collectors be worth manufacturing on a commercial scale?



Measuring the dew collected by half a beet leaf

A home-made device to bring a maximum of dew to the plants

Why Trees Lose Their Leaves

By S. Leonard Bastin

ALTHOUGH some of us may feel regret when the summer goes we are really faced by the most splendid time of the year. During the fall months the country will undergo a wonderful transformation, for that greatest painter of all—the autumn—is about to spread a feast of color over the landscape.

The bright tints of the fall are closely associated with the death of the leaf. The working days of the foliage are passed and the sap, which has been flowing through the leaves, is withdrawing to the lower parts of the tree. Nature is far too good an economist to allow anything of value, which can be saved, to remain in the leaves. The carbo-hydrates and the albuminous matter which have been manufactured with the aid of the sun and air must on no account be wasted and these flow, with the sap, to the woody branches and the underground root-stock. The leaf that is left behind is a dead thing; its cell chambers quite empty save for certain yellow granules. Now these may be regarded as the direct cause of the autumn tints, and, where they undergo no further change, the foliage is of a clear yellow color. Now and again in the process of decomposition there appears a special product which botanists have called antho-cyanin. This may stain the leaves a brilliant scarlet or, when in conjunction with certain acids which are present in some leaves, it will produce a bluish purple.

In the break-up of the wonderful system which is present in the living leaf there seems to be no limit to the variety of coloring that may be evolved.

Of course the actual fall of the leaf is a much more wonderful happening than a good many folk imagine. Most people have an idea that the circumstance is caused by the winds of autumn or is due to the action of early frosts. Actually the leaf is hardly formed ere preparations are made for its detachment from the stem. Right across the base of the leaf stalk there is formed a special layer of cells. This is a definite dividing line and has been well called the layer of separation. Now as the summer season advances these cells become increasingly spongy so that by the time all the good things have been withdrawn from the leaf a springy cushion has been formed. The attachment of the leaf is now so slight that it may fall off simply by its own weight, even if a gust of wind does not complete the severance. There is no open wound left behind when the leaf falls; nature is far too good a surgeon for that. The very layer of separation that brings about the fall of the leaf prepares a healed scar in advance. Even with all its wonders modern surgery cannot amputate a man's leg and leave behind a scar that is already healed.

A somewhat puzzling point in connection with the fall of the leaf is the fact that certain trees always part with their foliage in a particular way. In the case of the English beech (*Fagus sylvatica*) it is the most newly formed twigs that lose their foliage first of all. Thus while the inner branches are quite leafy the outmost boughs will be destitute of foliage. With birches and poplars the reverse is the case; it is the most recently formed foliage that stays on the longest. A row of Lombardy poplars in the fall looks almost ridiculous with its tufts of foliage adorning the topmost branches of every tree. A peculiarity of the ash is that its main-stalk remains long after the leaflets have fallen while young oaks and beeches sometimes do not shed their foliage (though it turns brown and withered) until the spring.

The shedding of the foliage of the tree is associated with the need for rest on the part of all plants. Very few plants are able to keep on growing from one year to another without a pause. Even the so-called evergreens are not in an active state during the winter. As well all trees secure a mechanical advantage from the loss of their foliage in the autumn. The coming winter brings rough weather and the resistance of a tree in full leaf to the wind would be quite four-fold to that which would be present when the branches were bare. Now and again, when a hurricane does occur in the summer, the damage to trees is terrific.

Healed scar after fall of a chestnut leaf

Enlarged leaf-stalk base, showing layer of separation

Stalk of chestnut leaf just detached from the bough

The Current Supplement

A PHYSIOLOGICAL question of more than ordinary importance and interest is dealt with in an article on *Osmotic Pressure in Animals and Plants*, which appears in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2177, for September 22d, and in it is shown the great differences in conditions under which these two great divisions of living matter have developed. *Some of the World's Most Notable Bridges* gives general details of a few unusual structures in various parts of the world, and it is accompanied by several pictures of primitive structures by way of contrast. *Integrating Tachometers* describes and illustrates an ingenious instrument that enables marine engines, especially those of war vessels, to be accurately controlled. A vital necessity of the world at present is the conservation of food, and especially of grain, which constitutes such a great item. A serious enemy of the farmer, and also the consumer, is the graminiverous bird, the most prominent representative being the crow. Methods for dealing with their predacious habits are discussed in an article entitled *Destroying the Crow and His Cousins*, which is accompanied by numerous illustrations. *Commercial Alloy Steels* contains interesting historical and practical notes on the development and use of these invaluable materials. Although window glass is turned out by the square mile few of us know much about how it is made. The article on *Making Window Glass by Machines* tells a story that will be new and interesting to most everybody, and several cuts make the explanations clear. *Colloidal Chemistry in Paper Making* deals with a very important factor in the processes of producing this necessary material. Other articles of note are *Soap Treatment for Infected Wounds*, *Peat as a Coal Substitute*, *Earth Pressures*, and the *Development of the Army Dog*.

Surface Combustion

IN burning an explosive mixture of gas and air it is an essential condition that the mixture shall issue from the nozzle at a speed greater than the velocity of flame propagation in the mixture, otherwise the flame will spread into the nozzle and cause an explosion in the pipes and mixing chamber. On the other hand, if the mixture issues at such a speed as to preclude the possibility of backfiring, it will be traveling too fast to allow of its burning at the orifice, and the flame will be a scattered flare hovering about the place where the stream has slowed down to about the spread of flame propagation.

This latter condition cannot be tolerated in an enclosed combustion chamber, such as a boiler or metallurgical furnace, on account of the danger of explosions in the furnace itself, and a choice of two courses is therefore presented—either to bring the gas and air to a duplex nozzle in separate pipes, or to provide a means of checking the fast issuing stream of gas and air by placing an incandescent surface in the line of flow, and thus compelling the mixture to burn at that place. The first course falls short of the ideal for many reasons, and much attention has been given of late to the solution of the problem along the lines of the second course.

One method, that associated with the researches of Prof. Bone, is to force the mixture through a porous mass of refractory material in and upon which it burns, bringing the upper layer of the material to a state of high incandescence. Another method is to project the jet from the nozzle upon a bed of loose lumps of refractory material, so that the velocity is suitably reduced by this bed, and combustion takes place at or near its incandescent surface. In the latest developments of this second method, the mixture is directed from an orifice in front of the furnace in a downward direction, at an angle of about forty-five degrees, upon a bed of loose lumps of alundum. The bed slopes upward at an angle of about thirty degrees away from the furnace front, and the burning gases are thereby deflected upward again into the body of the furnace.

A high degree of efficiency is claimed for this type of surface combustion as compared with standard blastburners. In lead melting the surface-combustion furnace showed a saving of 33 per cent over an ordinary furnace. The process is said to be an ideal one for burning any kind of gas, but to have especial advantages in the burning of gas under boilers. The water-tube type of boiler is, probably, the one best adapted to it. By placing the tubes close to the bed advantage is taken of the high temperature and direct radiation without danger of incomplete combustion. Present experiments indicate that the only limit to the amount of gas that may be burned in a given space is the ability of the furnace materials to withstand the temperature.

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts

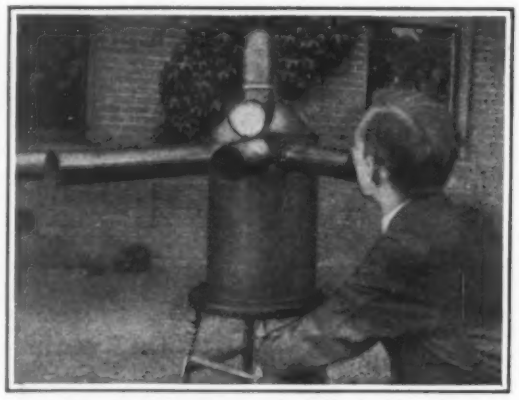
Singing Into a Tin Can to Test the Voice

THE odd looking device shown in the accompanying illustrations is the invention of Prof. Howard Harold Hanson, head of the Department of Musical Theory in the College of the Pacific, at San Jose, Calif. The invention is for the purpose of analyzing tones, particularly those of the human voice. Just as by other devices it is possible to hear the heart beat, test the blood pressure, know the condition of the lungs, and so forth, in respect to the functioning of the human body, Prof. Hanson, by his recently perfected device, has made it possible to determine scientifically the tonal qualities of the singing voice.

The three properties of tone, authorities tell us, are pitch, intensity and quality, and these are dependent on three factors of the vibration of the sounding body—frequency, amplitude and form of vibration, respectively—which, in turn, produce the differences of length, amplitude and form of the wave motion propagated. Referring particularly to the last-named property of tone, it may be stated, on the authority of both Ohm and Helmholtz, that the difference in quality between two tones depends on the presence and relative intensity of the various overtones present in the complex tone. Therefore, every tone is comprised of its fundamentals plus a variety of overtones, and it is the presence or lack of these overtones that determines the musical or non-musical quality of a given tone. Hence, overtones constitute the essential of the singing voice; and, briefly, it is the object of this invention to show just which overtones are present and which are missing.

The device is constructed principally of tin, and from the main body of it are horizontally extended, as shown, tubes of various sizes and lengths. There are sixteen of these tubes, and each is tuned to a different overtone of middle "C." For the test, the singer sings the five vowels on middle "C" into the protruding end of a tube; and the sound waves of the tone thus sung into the receiver enter a resonating chamber, which resonators record the presence or absence of the desired overtone by way of the vibrations of a tiny pendulum on a circular membrane. The test is repeated into each of the sixteen tubes, and by so doing it is readily determined which overtones need developing and which minimizing, in that particular voice, and on which vowel sound the most work is required.

The device analyzes any tone into all of its structural partials or overtones, but, naturally, it can do no more than indicate wherein the possible defects of the singing voice lie. The work of perfecting or developing the voice, with this knowledge of its qualities, must be accomplished through and by the vocal teacher and student.



Testing the singing voice by means of a resonating-tube device

Each tube picks out a certain overtone

An Expandable Pulley Which Does Away with Gearing and Speed-Cones

WHAT promises to simplify numerous problems in the transmission of power has recently made its appearance in this country in the form of the expandable pulley invented by Mr. W. B. Dunbar of Sydney, Australia. This pulley, which is depicted in the accompanying views and drawing, possesses many advantages the more important of which are taken up in the following brief description.

From a technical point of view the outstanding features of Mr. Dunbar's pulley are the flat belt and the resilient working face. The pulley offers the great advantage of being able to vary the velocity ratios between the driving and the driven shafts at will, within a very wide range, and without in any way interrupting the transmission of power. How this is accomplished may be learned by studying the accompanying line drawing.

It will be noted that the principal component parts of the pulley are a pair of flanges, segments and vanes. The segments are of two classes, spring and master segments, the spring segments forming the first or lower diameter, with the master segments centrally situated underneath. These work between fixed flanges, having vanes sliding through them with guide slots to operate the expansion or contraction by a roller engaging in the body of the segments. The operation is such that the pulley retains its circumference at any diameter and solves a troublesome question which in the past has always exercised the minds of engineers.

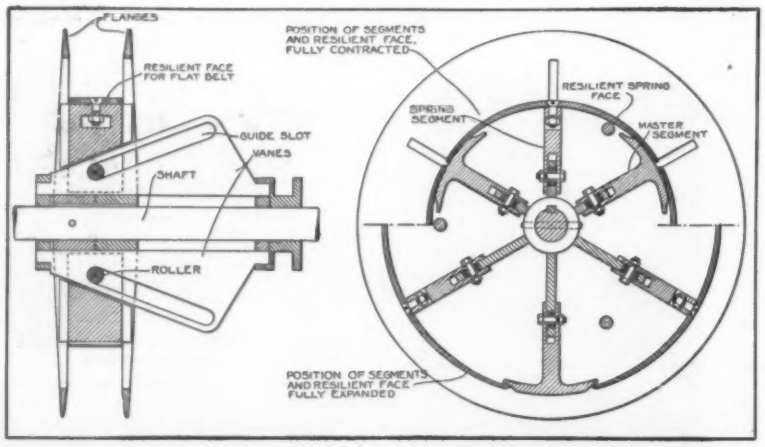
The many applications now awaiting the new expandable pulley can readily be visualized by any one conversant with power transmission problems. In the case of a variable-speed drive, for instance, two expandable pulleys can be used, each reversed with respect to the other, so that when they are properly connected together by a common control it becomes possible to obtain any speed within wide limits by shrinking one pulley and expanding the other simultaneously. This arrangement does away with the troublesome speed-cones generally in use, and offers a gradual speed control as compared to a step-by-step.

Another fertile field for the new pulley should be in the case of electric motor drive, for the pulley can then act in the capacity of a clutch; that is to say, the motor can be started up with the pulley collapsed, so that the belt slips with little or no load, and after the driving power has reached the normal speed the pulley can be gradually expanded, gripping the belt and gradually taking on the load. This method of electric drive would do much to solve the starting problem of today, and would simplify electrical starting apparatus. Equipped with an idler pressing against the belt, the expandable pulley can be used as a variable-speed pulley since the slack in the belt is then taken up.

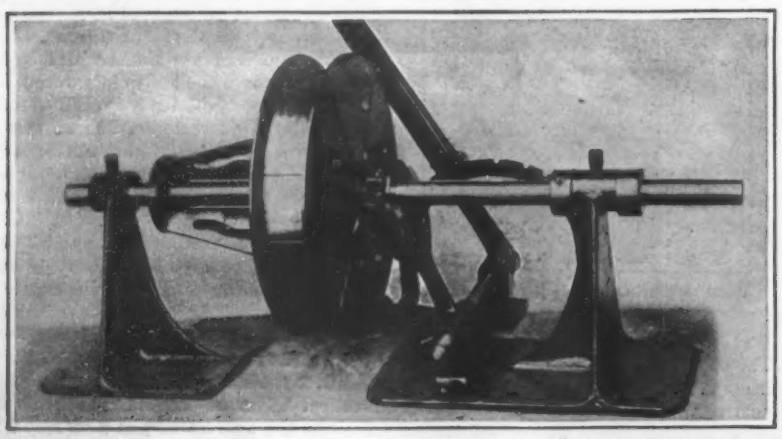
Mr. Dunbar has applied his variable speed pulley to an experimental automobile with considerable success in Australia, doing away with the usual gear box. There appears to be a field in its application to automobile construction, judging from the results of the tests.

That the new expandable pulley is beyond the experimental stage is proved by the fact that a number of them are now in use in several Australian plants, and it is reported that they are giving absolute satisfaction.

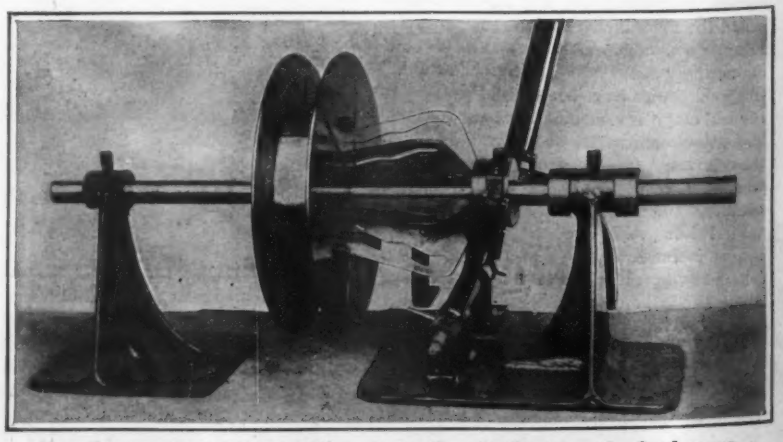
Summed up, the advantages of the expandable pulley appear to be as follows: The pulley enables anyone to drive a machine at any speed within wide ranges and at definite speeds. It works with an ordinary flat belt. It can be made in sections and fitted to any shaft without removing present gear. It permits change of speed without interrupting the transmission of power. It is applicable to any machine from a high-powered press to the most delicate mechanism. It can be made as a standard unit to be applied to existing machines. It has a minimum of parts, all of which are interchangeable.



Sectional views showing how the face of the pulley expands



Variable speed pulley fully expanded. This one is of the step-by-step model, with a lever engaging with a notched arc piece



Completely collapsed the variable speed pulley clearly shows the fixed vanes which slide through slots in the flanges

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of SCIENTIFIC AMERICAN.

Pertaining to Apparel

LADY'S HEAD-GEAR.—JUANITA TRAMANA, care of Mrs. M. D. Troutman, 351 Wadsworth Ave., New York, N. Y. The invention relates to improvements in ladie's hats whereby they may be interchanged for use in a variety of forms, the object being the provision of a lady's hat, the parts of which are susceptible of ready and quick detachment so that the hat may be dismantled, and its parts packed in small bulk within space of limited capacity without crushing or breaking, among the many forms for which the frame may be used are an automobile overdrape, a turban, or a widow's bonnet.

GARMENT.—MABEL M. LAUZON, Hibbing, Minn. The object of the invention is to provide a garment, designed to take the place of the kimono and arranged to properly and neatly fit the wearer, and to allow of quick and convenient opening and closing of the garment without the

FRONT VIEW OF GARMENT IN CLOSED POSITION

use of buttons, hooks and eyes, or similar fastenings. The garment is open along the front media line from the neck to a short distance below the waist line, provision is made for the front to overlap, tying bands being adapted to pass rearwardly over the sides above the hips to the back for tying into a bow.

Electrical Devices

RELAY.—D. P. WILLIAMS and J. F. WILLIAMS, 52 Vanderbilt Ave., New York, N. Y. The invention relates to electric relays for setting up in one circuit electric impulses derived through another circuit. A specific object is the provision of a form of diaphragm and means for mounting same whereby the diaphragm is unclamped as its peripheral edge is supported free as distinguished from diaphragms which are clamped entirely around their peripheral edge in the body of a receiver or transmitter. Another object is the provision of an arrangement of energizing electromagnetic means and microphonic means for obtaining a maximum conversion of electric impulses in one circuit derived from another circuit.

Of Interest to Farmers

THERMOSTAT OR HEAT REGULATOR FOR INCUBATORS.—C. P. MCANDREW, Ellsworth, Wis. This invention relates to thermostats of the bi-metallic bar type and has for its general object to improve their construction and operation so as to be reliable and efficient in use, and so designed as to be extremely sensitive, so that when applied to an incubator the temperature can be maintained substantially constant within very narrow limits.

BEET SEED CLEANER.—J. F. JARRELL, 710 Park Place, Longmont, Colo. The invention relates to means for separating seeds, berries, and the like from dirt, leaves, twigs or other matter, and among the objects are to provide a machine having a relatively great capacity through the use of a plurality of cleaning units, which units are caused to travel while held in inclined planes and to be agitated at one point while held steadily at all other points during such travel.

HAY BALER.—W. H. HILLIGASS, Payson, Arizona. The invention relates to hay baling process among the objects thereof are to provide such a press wherein bales are made of uniform size by means of a plunger having a predetermined degree of travel, the device is simple in construction and use; composed of few parts and not likely to yet out of order, it is comparatively inexpensive, and may be used for baling other material than hay.

Of General Interest

TRAIN-STOPPING TRIP OR OBSTACLE.—J. F. MCCOY, address Mary McCoy, 170 India St., Brooklyn, N. Y. The invention relates to train stopping trips adapted to be set up in the truck by a trainman of a train that has been stopped, so as to protect such stopped train from accident by a succeeding train colliding with it. The device is so designed that when it has performed its function it automatically moves to inoperative position so that the track will be clear. The invention is a staff-like trip which can be destroyed by the burning of a time fuse or by the blow of a train.

FILM INDICATOR.—M. A. GODWIN, Bridgewater, Mass. The invention relates to kinetoscopic projectors with especial reference to where two projectors are employed in a booth and alternately operable, continuous projection by two projectors requires that the lamp in the inoperative projector must be energized a few moments before the completion of projection of a reel in the operating projector in order that the arc between the carbons shall be white and steady when the inoperative projector is started. It is now the practice to open the magazine door to determine the time to energize the lamp, with this indicator time to "light up" is clearly shown, and the objectionable practice of opening the magazine is overcome.

GASOLINE TANK AND FILTER.—H. W. CHYNOWETH, Pasadena, Calif. The invention has for its object to provide a tank and filter for use with internal combustion engines, wherein a main tank or reservior is provided with an auxiliary tank, the latter having means for causing sediment in fuel to be deposited where it may be withdrawn and wherein the fuel is taken from said auxiliary tank to the carbureter through a screen.

SEAL.—R. A. EDGAR, address 202 S. Lincoln St., Chanute, Kan. The object in this invention is to provide a seal of simple construction adapted to be used with the ordinary car door-fastener, and which when bent and folded upon itself, cannot be detached without breaking the same, thus indicating that the seal has been tampered with, and wherein the arrangement is such that when the folded portion of the seal is detached there will be no connection between the parts remaining permitting easy removal of the body of the seal.

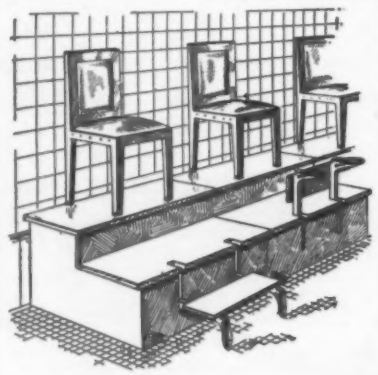
DEVICE FOR PREVENTING HENS FROM SETTING.—A. M. LARROWE, Canisteo, N. Y. The invention is particularly designed to provide a humane arrangement which will permit of the free use of its limbs by the bird to which it is attached, and which will at the same time effectively operate to prevent the bird from setting. The device includes a band secured around the upper portion of the leg above the leg joint, an upright stem having an upper angular portion flexibly connected to the forward portion of the band, and having its lower portion bent to form a ring adapted to encircle the lower portion of the leg below the leg joint.

BATH-TUB OVERFLOW SHIELD.—J. SERPER, 116 E. 119th St., New York, N. Y. An object in view is to provide a shield for the overflow of bath tubs, which may be readily applied and removed at any time and when in position will cause the level of the water to be raised. Another object is to provide a shield having a cushioning member for engaging the tub, and means for removably securing the shield to the guard of the overflow pipe so that the shield may be quickly applied and when in position will be substantially watertight.

PENCIL SHARPENER.—W. S. DOE, Prospect St., Kent, Ohio. The object is to provide a pencil sharpener, which is simple in construction durable and cheap to manufacture, which will permit quick and convenient sharpening of pencils of various shapes with a view to produce pointed portions of any desired length.

GRID FOR FRYING-PANS AND THE LIKE.—O. C. RICHARDSON, London, England. The invention relates to a draining grid, adapted to be supported by clips or hooks from the side of the pan, which when in use for draining purposes, does not obstruct the use of the whole of the bottom of the pan for cooking, the device may also be used as a support for food to be cooked by steam in a saucepan or the like in which water is being boiled.

STAND FOR SHINING SHOES.—M. A. MATHEWSON, 311 Davis St. Elmira, N. Y. The invention relates to movable foot supports on the stand so as to facilitate the engagement of the seat by a person whose shoes are to be shined and also to eliminate the danger of soiling the



A PERSPECTIVE VIEW OF STAND SHOWING FOOT REST RAISED AND LOWERED

clothing while getting on or off the stand. An object is to provide a simple device which in addition to serving as a foot rest, will also serve as a step for facilitating the walking of a person on to or from the stand.

Hardware and Tools

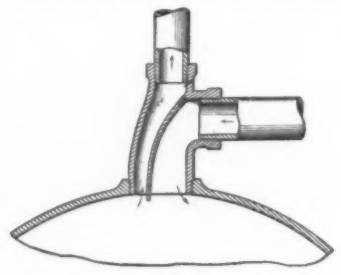
BORING TOOL.—H. SCHNECKLOTH, Holstein, Iowa. The general object of the invention is to provide a boring tool of simple construction that may be readily applied to a piece of work to provide a bit-carrying means which may be quickly shifted. A more specific object is to provide a bit and headstock having effective guiding means to prevent the bit from running out of true.

BUCKET ELEVATOR.—W. W. HUDSON, 80 Second Ave., Salt Lake City, Utah. The object of the invention is to provide a device especially adapted for the expeditious handling of crushed ore, stone, and like material, wherein a cable is used for supporting the buckets, the buckets which are of usual construction are connected with the cable by means of connecting plates, the plates serving a double function, namely, that of connecting the buckets and reinforcing the rear wall of the buckets.

ROD COUPLING.—R. H. SWARTSFAGER, box 936, Drumright, Okla. The invention has for its objects to provide a coupling for connecting sucker or pumping rods for oil wells and the like, in such a manner that they may be quickly and easily coupled and uncoupled and a reliable locking means for preventing disengagement of the coupling.

HORSESHOE.—J. E. MURRAY, 36 Vernon Terrace, East Orange, N. J. The object of this invention is to provide a horseshoe having a section of which is secured to the horse's hoof, and which has horizontal guideways in which guides on another section may slide, the second section being held in place by clamps and it being possible to provide this second section with calks or with any other desired surface.

PIPE FITTING.—G. K. GILBERT, 114 Second St., Juneau, Alaska. The invention relates to a fitting particularly suited for hot-water-pipe connections. An object being to provide a fitting which will facilitate the circulation of hot water in connection between the hot-water-heating



A SECTION THROUGH A STORAGE TANK PROVIDED WITH THE DEVICE

coil and the storage tank or range boiler. The device consists of a T-shaped fitting having a partition separating two openings and bringing each of the openings into direct communication with a third opening, said partition projecting out of the third opening and having a vent in proximity to the two openings separated by the partition.

CARPET AND FLOOR CLEANING TOOL.—G. E. WIGHTMAN, 90 Eleventh St., Portland, Ore. The object of the invention is to provide a tool having a brush for scrubbing carpets and floors with a cleansing material, the tool having an extending edge for scraping off said material from the carpet when the cleansing has been completed. Wood linoleum, tile, marble and similar floors may also be cleaned by the brush, the cleansing material may be removed by a drier carried by a bracket on the tool.

Heating and Lighting

GASOLINE LAMP.—J. OWENS, 1224 29th St., N. W., Washington, D. C. As is well known, the gasoline lamps now in use are of a complicated construction. The object of this invention is to provide a gasoline lamp, the construction, connection, and coöperative action of the several parts being such as to not only permit of installing the lamp in the first instance, but the repair or substitution of any one of its several parts in a quick and convenient manner without the necessity of skilled labor or the use of special tools and implements for this purpose.

VAPOR GOVERNOR.—P. L. GUEST, 41 Luckie St., Atlanta, Ga. The invention has for its object to provide means for use in connection with steam heating systems, for regulating the temperature, and to prevent over pressure in the boiler and system. The improvement comprises main and auxiliary columns having connections with the boiler so that the water in the boiler has free access to the main column. While the auxiliary column is subject to vapor pressure. The structure is intended to prevent undue pressure and a float in the main column automatically controls the draught.

AUTOMATIC HEATING SYSTEM.—A. P. BROOMELL, York, Pa. The invention relates to automatic heating systems in which steam is used a heating medium of the so-called low pressure or vacuum type. An object is to provide means whereby the radiators of a system may be completely filled with steam, without permitting any of the steam to escape to the outer atmosphere through the "return" pipe. A further object is to provide a thermostatic element which is designed to operate (by means of fluid pressure) a valve at the radiator for turning on or cutting off the supply of steam.

HEAT DISTRIBUTOR.—JENNIE P. RICE, care of Norman E. Rice, 10–12 W. Huron St. Chicago, Ill. This device is adapted to be disposed upon the top of a range or to be utilized in connection with a gas burner, or as a lid for a range or similar stove, it will form a double hot-air chamber beneath a cooking utensil preventing the contents from burning during the cooking process, the distributor having a removable portion whereby a single hot-air chamber may be provided, and whereby direct heat from the fire box may be applied to the utensil when the distributor is used as a stove lid.

Machines and Mechanical Devices

VENDING MACHINE.—J. L. HACKETT and W. J. BOLL, address Edgar W. Dana, Platteville, Wis. The vention relates particularly to a machine which will vend a certain number of articles and then be thrown out of operation. A further object is to provide a machine of minimum size of simple strong construction for vending small articles, such as packages of canding chewing gum and the like, provision being made for a rotating vending member operated by a coin with means for discharging the coins after they have performed their work.

SHUTTER FOR MOVING PICTURE MACHINES.—C. R. SMITH, Fulton, Kan. An object of the invention is to provide a simple easily operated device which may be applied to existing machines with changing the machine. A further object is to provide a shutter that will give a better desolving effect of light which is less noticeable by the eye.

BRICK FORMING MACHINE.—G. E. RICHMOND, Austin, Texas. The invention relates particularly to a machine of novel construction for forming bricks of an agglomeration, such as garbage. The object thereof is to provide an automatic machine which is simple inexpensive and efficient.

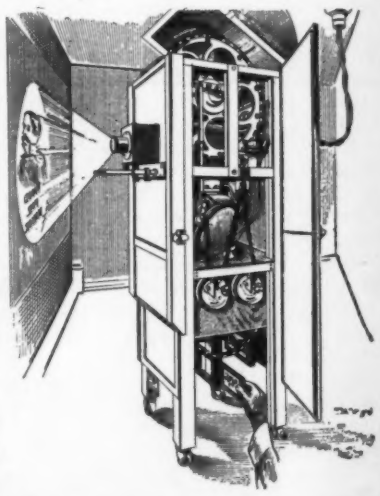
LEATHER CUTTING MACHINE.—L. H. GAFFNEY, P. O. Box 163, Terry, Mont. The invention relates more particularly to machines for cutting leather in harness making, although it may be used for cutting leather in other instances, as for trimming hides, or may be used in connection with materials of various natures other than leather and for various purposes in the cutting of such other material.

JOGGER ATTACHMENT FOR PLATEN PRINTING PRESS.—L. F. HOWARD, West, Texas. One of the principal objects of the invention is to provide an automatic jogging attachment for platen presses, especially for use in connection with and on Chandler and Price's Gordon and New Series presses, of such construction as to be readily mounted directly upon the regular receiving board of the press and without the necessity of altering the press in the least.

VALVE SEAT.—R. H. ALDRICH, care of The Aldrich Pump Co., Allentown, Pa. The invention relates to valve seats particularly adaptable for valves used in pumps for circulating liquids containing abrasive matter in suspension. An object is to provide a simple and efficient valve seat, with means for maintaining the contacting or wearing surfaces of the seat clean from abrasive substances carried by the liquid which passes through the valve seat.

BUSHING FOR BRAKE CAMS.—J. I. D. BRISTOL, H. K. CURTIS and L. T. HUNTER, Chappaqua, N. Y. The invention relates machine brakes particularly to brakes adapted for automobiles or the like such as are commonly called emergency brakes. The primary object is to provide a bushing of peculiar construction that is adapted to be slipped upon the rotary cam of a hub brake, without disturbing any of the parts except the removal of the wheel or part which carries the brake drum, the brake may be suitably corrected to render it functional without replacing the shoe when correction is required at a time or place when new shoes are not accessible.

ADVERTISING MACHINE.—H. M. WOOD, care of *The Reporter*, Greenfield, Ind. The invention has for its object to provide a device which will automatically bring a series of slides or plates into operative position for projection successively at intervals. A further object is to provide a device comprising an endless chain



A PERSPECTIVE VIEW, ONE OF THE SIDE DOORS BEING OPEN TO SHOW THE MECHANISM

upon which the plates are suspended with means for moving the chain intermittently and for stopping the same in its movement when the plates have been brought into operative position and again starting the operation of the device at any predetermined time. A further object is to provide means whereby the plates or slides may be quickly shifted from one position to another and allowed to remain a sufficient length of time for projection, and for removal and substitution of other plates during the interval of rest.

DUMPING DEVICE FOR EXCAVATING BUCKETS.—F. T. CROWE, St. Ignatius, Mont. The invention relates to excavating apparatus and has particular reference to a mechanism for operating the buckets to load and unload the same. The invention contemplates providing

(*Concluded on page 216*)

Fighting With Axe and Saw

(*Concluded from page 204*)

similar to portable saw-mill logging and tie cutting in Massachusetts, Connecticut, Maryland and Virginia. The larger logs will be sawn into boards and dimension material, while the smaller trees will be cut into hewn ties, poles, props, etc. The closest possible use of timber will be required.

Not only is this regiment of lumberjacks going to supply lumber to the French, British and American troops, but supply it with the highest regard for the most intensive method of forestation. The French forestry methods are perhaps as advanced and scientifically correct as any in the world and it is intended that all timber cutting shall be done with a due regard to these French methods and to preserve as far as possible the future growth of French forests.

Much careful thought on the part of the forestry authorities and complete information as to exactly what is needed in France has resulted in negotiations for the following equipment, determined upon as essential.

Five mobile steam driven saw-mills will be carried, with a capacity of 20,000 board feet of lumber, each, in ten hours. It is intended to work these mills in two shifts each, making their total capacity 40,000 board feet or 200,000 board feet per day for all mills. These mills are now being built, with the three cardinal points of large capacity, great durability, and complete portability in mind.

In addition five small portable mills will be carried with a capacity of from eight to ten thousand board feet per ten hours. These will be of such size and character as will permit them readily to be moved about by four-horse teams. They are intended for work on very small woodlots where time and effort necessary to set up the larger plants would not pay. These small mills are of the general character which can be found in central New England.

While a great many horses will accompany the regiment and all logging operations as distinct from the manufacture of board and heavy timbers will be accomplished with horses, it is intended as far as possible, to make this a motorized regiment. Six high powered tractors will be carried and 12 heavy duty motor trucks. Seventy-two trailers of a capacity of five tons each have been provided to be hauled by the tractors. These trailers are little more than heavy steel-tired wagons, springless, but built for durability with the purpose of hauling out lumber from the mills.

As this motorized lumber feature is somewhat of an experiment it is not known exactly how many such trailers can be hauled by a tractor, particularly with a lack of information as to exactly what character of ground the outfits will have to run upon.

Both to take care of any contingency which may arise and to provide for quickly getting out lumber from larger areas where something like a permanent base can be established, 25 miles of light steel rails will be carried. To run upon these, axles and wheels will be taken along and small tram cars made at the spot. These will be moved by horses although the experiment will be tried of putting some of these wheels on motor trucks and running them so equipped upon the tram lines when they are established.

Of course a complete equipment for caring for all the machinery will be carried. Many machinists form part of the regiment, with a complete machine shop, blacksmith shops, farriers for the horses, a large quantity of saws and axes of all varieties and the necessary kitchen equipment for as many field stations as need to be erected with a saw mill as a center.

A word of explanation regarding our photographs may be in order. They are not presented with any pretense of having come from France. They merely show those aspects of the day's work in a lumber camp which will be duplicated in the tasks these foresters will have to perform when they get into action. As a matter of fact, they are taken in England, where American forest experts have been engaged in helping the English meet their timber problems.

RECENTLY PATENTED INVENTIONS

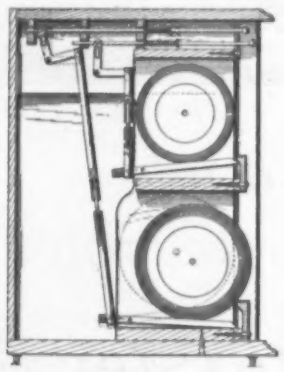
(*Concluded from page 214*)

an excavating bucket adapted for support on the cableway or swing crane and having a drum associated therewith and provided with a central disk to which is adjustably connected one end of a trip line the other end of which is attached to the usual drag line employed in apparatus of this nature.

Musical Devices

ZITHER ACTION.—S. C. OSBORN, Masonic Temple, Chicago, Ill. The invention relates to zithers and similar musical instruments, the object being to provide a new zither action more especially designed for playing the melody strings, and arranged to maintain a proper alinement and co-action of the keys with their hammers on pressing the keys for actuating the hammers, with a view for the hammers to properly sound the melody strings.

RECORD CABINET.—J. L. REESE, Hazelton, Pa. The object is to provide a cabinet with a plurality of record compartments from which the records removed by mechanism consisting of a supporting member for each compartment



A SECTION OF THE CABINET

normally in position to retain the record therein, and when released to permit the same to be adjusted by the weight of the record to a position wherein a portion of the record will project from the compartment so that it may be readily grasped and removed.

WOOD WIND MUSICAL INSTRUMENT.—G. STERBERG, Agaña, Island of Guam. This invention is an improved keyboard which as applied to a clarinet or instruments of the flute type provides mechanism whereby the player is enabled to make all the notes, and to actuate the complete mechanism simultaneously without shifting the fingers and without cross fingering.

Prime Movers and Their Accessories

MULTIPLE-FUEL CARBURETER.—L. A., E. T., and E. L. STRAUBEL, Green Bay, Wis. The invention relates to the class of internal combustion engine in which provision is made for burning either gasoline or a heavier oil as kerosene, distillates or alcohol. The object is to provide an engine in which said fuels may be burned interchangeably, that the change may be made by the simple adjustment of a valve that the fuel may be aerated with a quantity of air and then heated to a high temperature, and that cool air may be mixed with the heated vapor in a desired proportion before entering the combustion chamber of the engine.

PNEUMATIC STARTING DEVICE FOR INTERNAL COMBUSTION ENGINES.—C. G. EIDSON and T. DAVIS care of Thomas Davis, Industrial Bldg., Baltimore, Md. The object of the invention is to provide means by which an internal combustion engine such as the motor of an automobile may be started by pushing a pedal or other similar device, the starting being accomplished by means of compressed air. A further object is to provide means for furnishing a continuous supply of compressed air, said means being driven by the internal combustion engine.

AUTOMATIC TANK-CLOSING DEVICE FOR OIL BURNING LOCOMOTIVES.—J. H. MILLER, 428 So. C. St., Arkansas City, Kans. The invention relates to means for controlling the oil outlet leading from the tender to the fire box of a locomotive. A further object is to provide means whereby to automatically close the oil outlet in the tender by throwing the engineer's valve of the brake system to emergency position which is done when a wreck is imminent.

Railways and Their Accessories

NOISELESS RAILWAY CROSSING.—T. J. GRIFFITH, 539½ S. Olive St., Los Angeles, Calif. One of the principal objects of the invention is to provide a crossing which will be operated automatically by trains approaching, or can be operated from a signal lower by electric power. Another object is the provision of split or overlapping rail segments between the main rails of the crossing such rail segments being operable to form a continuous track at the crossing so that a train will pass thereover without jar or noise.

RAILROAD SWITCH.—I. E. PROMINSKI, 389 Prospect Ave., Brooklyn, N. Y. The invention has for its object to provide a railroad switch which may be operated by the motorman from the car platform, without the necessity of stopping the car at a certain point, it being sufficient if the motorman stops near enough to the slot to permit of the insertion of the operating rod.

RESILIENT BUMPER FOR BELL YOKES.—R. R. WALKER, 36½ Canaan St., Carbondale, Pa. The object of the invention, which relates to appliances for bells such as are commonly used on railway locomotives is to provide means to resiliently limit the extent of rotation of the bell yoke and bell secured thereto, a further object is to provide an attachment adapted to be used in connection with present locomotive equipment, with little or no alteration, that will serve to prevent the complete overturning of the bell yoke or the stopping of the bell yoke at the dead center when the bell is inverted.

Pertaining to Recreation

GAME.—JULIA A. BURT, 48 Lefferts Place, Brooklyn, N. Y. The game comprises a chart having imprinted thereon parallel lines arranged in simulation of a musical staff and leger lines associated therewith, and a plurality of movable game pieces each having a designating mark corresponding with the designation of some one of the lines or spaces on said staff. The principal object of the invention is to familiarize a student with the location of musical symbols on the staff and leger lines, to lend attraction to the educational feature, and to form a game having instructive results.

TOY BALL.—C. O. GRIFFIN, 23 Metcalf St., Newbern, N. C. The object is to provide a ball, having thereon the representation of a face or faces, provided with a sectional cover of elastic material, this material being removable, a cord is connected with the ball, adapted to be wound beneath the cover or partially so, the cover section forming, a bust and a head covering the figure, the ball may be hollow with means for causing a rattling when the ball is shaken.

Pertaining to Vehicles

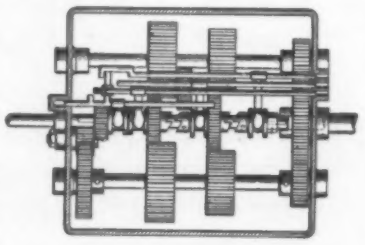
HEADLIGHT.—H. BASTOW, 377 Crafton Ave., Crafton, Pa. The object is to provide a headlight designed for use on automobiles and other power-driven vehicles and arranged to project sufficient light ahead for the proper illumination of the roadway without producing an undesirable glare. The light diffusing disk is made of pressed glass etched on its surface to produce a light-diffusing effect for rays of light emanating from the lamp, the disk is provided with a projecting hub with one or more openings so that a portion of the light may pass directly onto the roadway.

FOLDING BED FOR AUTOMOBILES.—G. GALLAVAN, Ordway, Colo. The object is to provide a bed so arranged that it may be folded into small compass for transportation in an automobile and which when unfolded and set up, will form a bed of reasonable size. The mattress or covering for the body is of canvas and is connected to the side rails by means of straps, the canvas is connected with the end rails by forming tubular portions at the ends of the canvas through which the end rails are slipped.

ANTI-RATTLER.—R. C. PUCKETT, 1049 Woodlawn, Iowa City, Iowa. The invention relates to means for preventing the rattling of doors particularly automobile doors, the main object is to provide a device of simple construction, ready installation, maximum efficiency, of low cost, and which may be adjusted to meet different conditons.

AIR VALVE ATTACHMENT.—J. RUZICKA and D. L. GRANTHAM, Lankin, N. D. The prime object of the invention is to provide a dust cap and a co-acting element so formed and arranged that the dust may be quickly engaged and disengaged with the threads of the air valve, thereby avoiding the necessity of screwing the cap any material distance on the valve in applying and removing the cap. The cap is made resilent at the threaded portion, one or two turns will cause the resilent portion to firmly bind on the threads of the stem.

CHANGE SPEED GEARING.—G. Q. SEAMAN, 161 Menahan St., Brooklyn, N. Y. The object is to provide a change speed gearing especially designed for use on automobiles and other power-driven vehicles, and devices, and arranged



SECTIONAL PLAN VIEW

to permit the operator to readily shift from a lower to a higher speed and in doing so causing the lower speed to move automatically out of action and without moving out of gear with its companion gear wheel

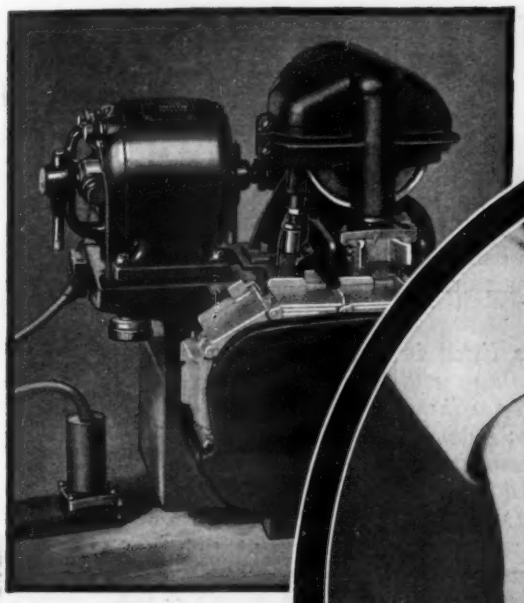
Designs

DESIGN FOR A TEXTILE TRIMMING.—A. S. FREED, 256 Fifth Ave., New York, N. Y. The figure accompanying this patent shows an ornamental design for a textile trimming.

DESIGN FOR A WHEELED FIGURE TOY.—L. MORSE, care of Rite Specialty Co., 35 W. 36th St., New York, N. Y. The design is a ball mounted between two wheels, with a smaller ball above it representing a cats' head.

DESIGN FOR A RING.—B. GLASSMAN, 106 Fulton St., New York, N. Y. The figure of the design shows a ring mounting with six sides, on two of which are engraved the American flag, the other four representing Washington, Lincoln, Liberty and Uncle Sam.

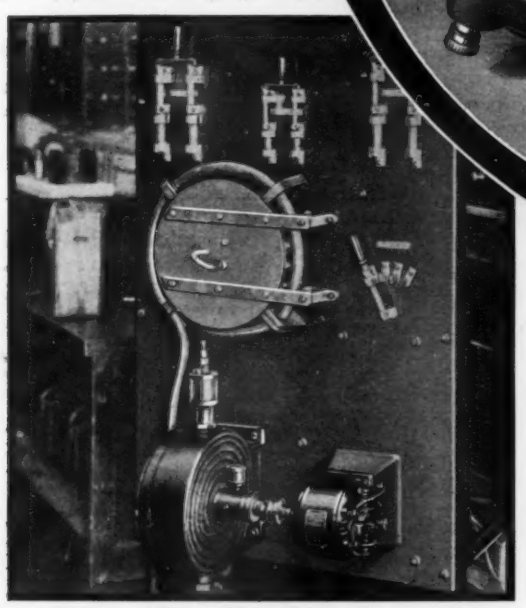
NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of patentee title of the invention, and date of this paper.



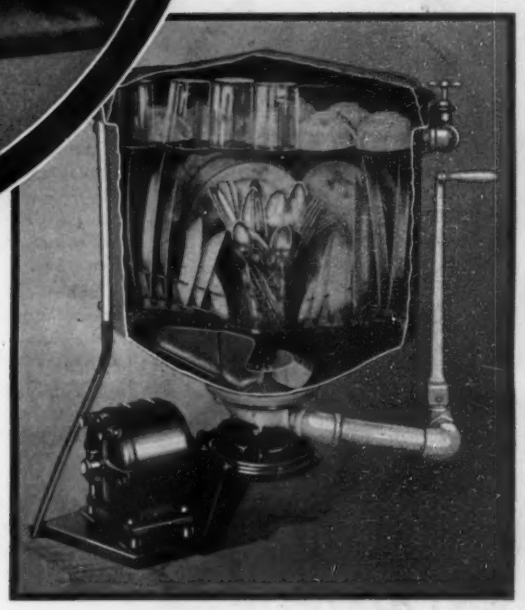
Westinghouse Motor operating tag marker.

Film re-winder equipped with Westinghouse Motor.

Westinghouse Motor attached to wireless rectifier.



Dish-washing machine run by Westinghouse Motor.



WESTINGHOUSE ELECTRIC

Coming Questions and Waiting Answers

Take a small motor apart, examine its parts carefully, and even if you are an engineer, you can't tell whether it's the right motor for your job.

Material, mechanical construction, workmanship —these you can observe, but the question of how the motor will meet your requirements remains to be answered.

If the motor **is** a Westinghouse, however, the answer probably has been reached long before your problem arose, by experience with the same kind of motor on the same kind of job.

That's where you profit by the great number and variety of Westinghouse Small Motor installations.

No matter how unusual your requirements, the chances are a Westinghouse Motor is doing similar work somewhere, whether it be operating a dish-washer or wireless rectifier, running a tag-marker, re-winding films or serving any one of the numberless motor purposes.

Westinghouse Small Motors include hundreds of standard sizes and types, and Westinghouse is always ready to design a special motor where warranted.

Moreover, the selection of the right motor for your job is made by application engineers who have had unusually wide experience in this kind of service.

Westinghouse engineers will be glad to consult with you or your engineers on any questions affecting motor application.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY
East Pittsburgh, Pa.

Westinghouse

ELECTRIC MOTORS AND CONTROLLERS

FOREIGN COMMERCIAL NOTES AND QUERIES

The SCIENTIFIC AMERICAN has always enjoyed a wide international circulation. Its voice is heard in the remotest corners of the earth. Now that American manufacturers have been stirred to the advantages of international expansion we are anxious to do our part in bringing American products into foreign markets. Hence this department has been established to pave the way for American trade expansion to all quarters of the globe.

Those who are interested in the trade opportunities listed in this column, can obtain the names and addresses by complying with the following simple rules: 1. Write only one inquiry on a sheet. 2. Always give the serial number. 3. Write on your own business letterhead. The SCIENTIFIC AMERICAN assumes no responsibility for the financial standing of concerns or individuals. Address all communications to the Query Editor of the SCIENTIFIC AMERICAN, Woolworth Building, New York.

647.—An agency is desired by a man in British Guiana for the sale of lumber, galvanized sheets, nails, salted and fresh butter, provisions, wine in bulk, pollock and salted cod fish, canned goods, bottled beer, and cotton-seed oil. Payment will be made by sight draft 10, 15, and 30 days, or cash against documents in New York. Correspondence may be in English. References.

648.—A firm in British East Africa wishes to buy very cheap and medium priced leather and canvas boots and shoes in all sizes for men and women. About 1,000 pairs can be used annually. Catalogs, prices, and, if possible, samples should be submitted. Payment will be made by sight draft with bill of lading attached. Goods should be packed in extra strong cases with waterproof wrapping or lining. Correspondence may be in English. Reference.

649.—A firm in Peru desires to be placed in communication with American manufacturers and exporters of surgical instruments.

650.—A man in France wishes to purchase condensed milk and roofing paper. Large quantities will be ordered if quotations are reasonable. Payment will be made by cash against documents. Correspondence should be in French. References. He will consider an agency for the sale of these goods.

651.—A merchant in Australia desires to represent American manufacturers and exporters of general merchandise, especially boot and shoe findings, patent leather, upholstery leather, all kinds of artificial leather, and fiber board.

652.—An importer in Switzerland is in the market for large quantities of linseed oil, lubricating oils, and benzine. Quotations should be made f. o. b. New York. Payment will be made against bill of lading. Correspondence may be in English but French is preferred. References.

653.—A correspondent in Italy with a capital of $40,000 wishes to become agent for American goods. Has been twenty years agent for typewriter and other companies. He is willing to accept the management of a branch giving ample security. Correspondence to be carried on in either English or French.

654.—Wanted the name and address of an American importer of French hand-embroidered lingerie for export to Costa Rica, C. A.

655.—A correspondent in Kirkwood, C. P., South Africa, is desirous of obtaining small tractors, the locality is a large irrigation settlement, and the farms are small, bearing from 10 to 50 acres, and the principal crop is Lucerne. Work is to be done with a pair of horses pulling a one-furrow plow, a 4-6 horse-power, mower is used. Then the hay has to be brought into the farm yard to be baled. The tractor is to be used for all these purposes.

656.—A business man in British East Africa wishes to purchase galvanized wire screening, ⅛-inch mesh, 18 to 24 gage wire, 36 inches wide, put up in rolls of 60 feet. This material is used for making coffee-drying screens, and is now selling for 97 cents per square yard. About 500 rolls of this screening can be used annually Payment will be made by sight draft with bill of lading attached, or cash against documents in New York if absolutely necessary. Material should be packed in extra strong crates, with waterproof wrapping wherever possible. Correspondence may be in English. Reference.

657.—A manufacturer in Spain desires to represent American manufacturers and exporters of chemical and pharmaceutical products. Quotations should be made f. o. b. New York. Payment will be made against shipping documents. Goods should be packed in strong wooden boxes. Correspondence should be in Spanish or French References.

658.—An agency is desired by a man in the Canary Islands for the sale of cotton and silk goods. Correspondence should be in Spanish. References.

659.—A firm in Cuba desires to secure an agency, on a commission basis, for the sale of silverware, cutlery, and jewelry. Two members of the firm are at present in the United States, with whom interested firms may communicate. Correspondence may be in English or Spanish. Reference.

660.—A man in British East Africa is in the market for unbleached cotton piece goods weighing from 6½ to 7 pounds per piece. About 1,000 bales of these goods can be used annually. For details of the market for this product, see *Commerce Reports* of March 15, 1917. Payment will be made by cash against documents in New York. He also wishes to entertain an agency proposition. Goods should be packed in extra strong packing with waterproof lining, bales to have 12-ounce burlap and waterproof wrapping for each piece of soft goods inside. Correspondence may be in English. Reference.

661.—A business man in Spain wishes to represent American manufacturers and exporters of all kinds of small, readily salable merchandise. Payment will be made 90 days after receipt of goods. Correspondence may be in English. References.

662.—An agency is desired by a man in Italy for the sale of electric cables for underground electrical installation. Correspondence should be in Italian.

663.—A company in India desires to be placed in communication with American manufacturers and exporters of coal-tar dyes, and wishes to receive quotations and samples of best congo red, and direct red, fast to acid. These colors are desired to produce bright reds with yellowish tints and not blue tints when dyed on cotton. The more concentrated quality would be preferred, owing to the high cost of freight. Reference.

664.—A firm in England desires quotations on bright iron, flat-head panel pins, as follows: 5 cases of ⅜ inch, 10 cases of ½ inch, 10 cases of ⅝ inch, 20 cases of ¾ inch, and 20 cases of 1-inch pins, each case containing 1 hundredweight net. Quotations may be made f. o. b. New York. Payment will be made against documents at destination. Pins should be put in 1-pound paper packages and 5 packages to a parcel. Shipping will be arranged through New York agents of the firm. Reference.

Annual Subscription Rates for the Scientific American Publications

Subscription one year.....$4.00
Postage prepaid in United States and possessions, Mexico, Cuba and Panama.

Subscriptions for Foreign Countries, one year, postage prepaid..... $5.50
Subscriptions for Canada, postage prepaid... 4.75

The Scientific American Publications

Scientific American (established 1845)..... $4.00
Scientific American Supplement (established 1876)..... 5.00

The combined subscription rates and rates to foreign countries, including Canada, will be furnished upon application.

Remit by postal or express money order, bank draft or check.

Strategic Moves of the War, September 13th, 1917

(Concluded from page 206)

work and, on every hand, the Austrians with a single exception have been driven back.

The British continue to strike at the German lines at several different points, constantly wearing down their opponents and weakening them—this is being carried out with remarkable success.

The French commander, following his usual plans, starts with a near objective; having gained it, he awaits the counter-attack which he blows away with his artillery. Having succeeded at one point, another is tried with similar results—with small loss to the French but with a greater one to the Germans. This wearing-down policy is already showing results and the end is inevitable. German man-power and resources cannot hold out against the odds opposed—a fact that is no doubt only too patent now to her high command.

The Associated Press has recently published some official estimates of this drain, showing a total mobilization since the beginning of hostilities including the classes of 1920 of fourteen millions of men while those actually called up to the present amounted to 10,600,000. The losses in killed, permanently disabled and prisoners have amounted to more than 4,000,000 so far. Therefore in fixed formations at the front, on lines of communication, etc., there are actually at present approximately 5,500,000 men with 600,000 at depots, reorganizing, and 500,000 wounded and under treatment. There are probably therefore, actually on the fighting lines 5,000,000 men, two-thirds of whom are on the western front reaching to 3,000,000 as a fair estimate.

The English armies in France number about 2,000,000 men. M. Tardieu, French High Commissioner, in a letter to our Secretary of War recently said not only that the French armies in the field numbered 3,000,000 but also that "we are certain with the resources of our metropolitan and colonial depots, to be able to maintain that number up to its present level for a long time to come." This statement would indicate that France is far from being "bled white" at the present time. The Allies, therefore, outnumber the Germans in the west in the proportion of five to three; even if Germany will be able to withdraw large numbers of troops from her eastern front, the advent of American troops will still keep the proportion of numbers in the amounts given above or greater. It must, therefore, be only a question of time when Germany must fail under the strain.

The Submarine Problem—XV.

(Concluded from page 208)

Now, it is not necessary to point out that, with from one to three aeroplanes covering a wide stretch of water ahead of the ship, it would be practically impossible for a submarine to get within torpedo range, unobserved. The aeroplane pilot, looking down vertically, can see a submarine at depths of from 40 to 100 feet, according to the clarity of the water—40 feet in the North Sea and 100 feet in such clear waters as those of the Caribbean. Only in rough weather would it be difficult to see the enemy; but, as any one who has traveled the oceans extensively knows, the number of rough days at sea is much smaller than is popularly supposed.

The great success of the depth bomb as used by destroyers, gives enormous offensive value to the bombing aeroplane, and, conversely, the aeroplane renders the depth bomb far more efficient than it can ever be when used on a destroyer. The destroyer has to make a guess as to just what course the submarine is following after submergence, but the aeroplane, being able to see the submarine, can drop its bombs so close to the craft as to make sure of its destruction. It will not, of course, be possible to build all of our new ships along the lines here suggested; but a sufficient number of this aeroplane-carrying type can be built to send at least one across with every convoy. For this

purpose, the ship should have a speed of not less than 16 knots, in which case, even when traveling alone and without escort, she would be practically unassailable by the submarine. When she was heading a column of merchant ships under convoy, her aeroplanes, in any but the roughest weather, would afford such excellent means of detection and attack, as to provide a clear lane for the column of ships astern of her.

The Absent Treatment in Efficiency Tests

(*Concluded from page 209*)

engaged in a brief act, but one demanding a considerable effort of attention. Firing a carbine is a fair example of such an act, and one which M. Lahy employed, among others. Respiration and pulse are "taken down" by a recording needle, and the graph obtained permits clear classification. Good subjects adapt their organism spontaneously, either by arresting completely the respiration, or by modifying it noticeably. When a normal respiration would be in their way, in other words, they put it out of the way by breathing in such abnormal fashion as meets the needs of the situation. Their hearts and lungs are never "in their throats." Poor actors, on the other hand, respire in a disorderly fashion, giving a curve with no distinctive feature; they lack what M. Lahy has christened "functional plasticity."

Again, among the good men, the blood pressure curve maintains itself horizontally before the experiment, or at most slightly and rhythmically undulatory, and shows a prompt rise at the beginning of the test. The ascension increases until the discharge of the gun marks the end of voluntary effort, and then falls progressively. The rapidity of the return to normal again indicates great functional plasticity, this time on the part of the heart. On the other hand, the excitable subjects present curves of great irregularity. Further, among the good men the pulse increases during action, while among the poorer ones it remains fixed or even falls—their organisms are not responsive to the necessities of action.

The really extraordinary feature of all this is that every test works. If a group of gunners and feeders is classified according to the testimony of the officers who have observed them in action for a considerable period, and then subjected to M. Lahy's examination, the men of observed ability will pass with high standings, and those of known inability will fall down, hard. In every case, the good gunner or the good feeder will be found to possess the traits which M. Lahy calls for; and the converse statement, that the man possessing those traits will make a good gunner or feeder, will therefore be regarded as established within a reasonable degree of probability.

A School for Army Cooks

AMERICA'S world's famous hotel chefs are going to do their bit toward helping Uncle Sam win the war.

Uncle Sam knows how to provide the army with food and just what to buy. But it is one thing to provide good and nourishing food and quite another to cook and prepare it properly so that nothing is wasted and so that those who partake secure the full and proper amount of nourishment and enjoyment they should from it. Good cooks and doctors agree that many a meal is ruined in the kitchen and numerous folks suffer from indigestion not on account of the food they eat but rather because of the way it is cooked. This was just where Uncle Sam was up against it when the war broke out. The War Department had to face the finding and instruction of thousands and thousands of army cooks.

But where were they to come from? Really good cooks command high wages, much more than Uncle Sam can pay. Besides, they are usually employed and not looking for jobs. A few of course would be drafted but the majority are middle-aged men. Yet the War Department was determined, if it was possible to avoid it, that there would be no poor food scandals in connection with the army during this war, but rather that our men should go through the conflict with the reputation of being the best fed soldiers in the world.

Curiously enough just about the time Quartermaster General Sharpe was puzzling over this problem an idea came to Edouard Panchard, chef of a great New York hotel and one of the most noted cooks in the world. It occurred to Mr. Panchard, knowing his profession as well as he did, that Uncle Sam was going to have great difficulty in securing sufficient efficient cooks for his new army, and it seemed to him that a way in which the great chefs of the nation could show their patriotism would be by organizing to help the Government out in this emergency.

So early in May last, he formed a tentative organization among some of the chefs of his acquaintance in New York, and then addressed a circular letter to a number of the best known chefs all over the United States. In this he stated that an organization had been formed among the chefs of Manhattan called the "National Cooks Training Corps," the object of which was the instructing of enlisted men in good army cooking. Mr. Panchard further stated that the training corps had the endorsement of the War Department, with which he had been in communication, and that he was of the opinion that the plan was of vital importance to the country in this crisis. The only requirements for the instructors, it was stated, were that they speak English, and be experts in their line. Their services were to be given to the Government absolutely free and no fees were demanded to join the corps. Then the addressed was asked to become a member.

Of foreign birth and training as many of these chefs are the response to this letter was really remarkable and so gratifying that Mr. Panchard, as President of the National Cooks Training Corps, felt justified in writing, in a few days, to the War Department that he was prepared to furnish all the fully trained men the Government might need as instructors to the army cooks and that when the time came for their services all that was necessary to start the work was for the War Department to instruct every Corps Commander of the different camps to communicate with him. He would then give directions as to how the commander could get in touch with the instructors designated by the National Cooks Training Corps for his camp or cantonment.

Meanwhile Mr. Panchard carefully prepared a course of instruction in army cooking for the chief instructors themselves so that they might be the more fully qualified to teach others. While they were all men whose knowledge of cooking is indisputable yet at the same time there are not a few differences between the preparation and cooking of army rations and of the food for hotel dining rooms, and the War Department does not sanction anything that deviates from the rules set forth in the army cooks' manual.

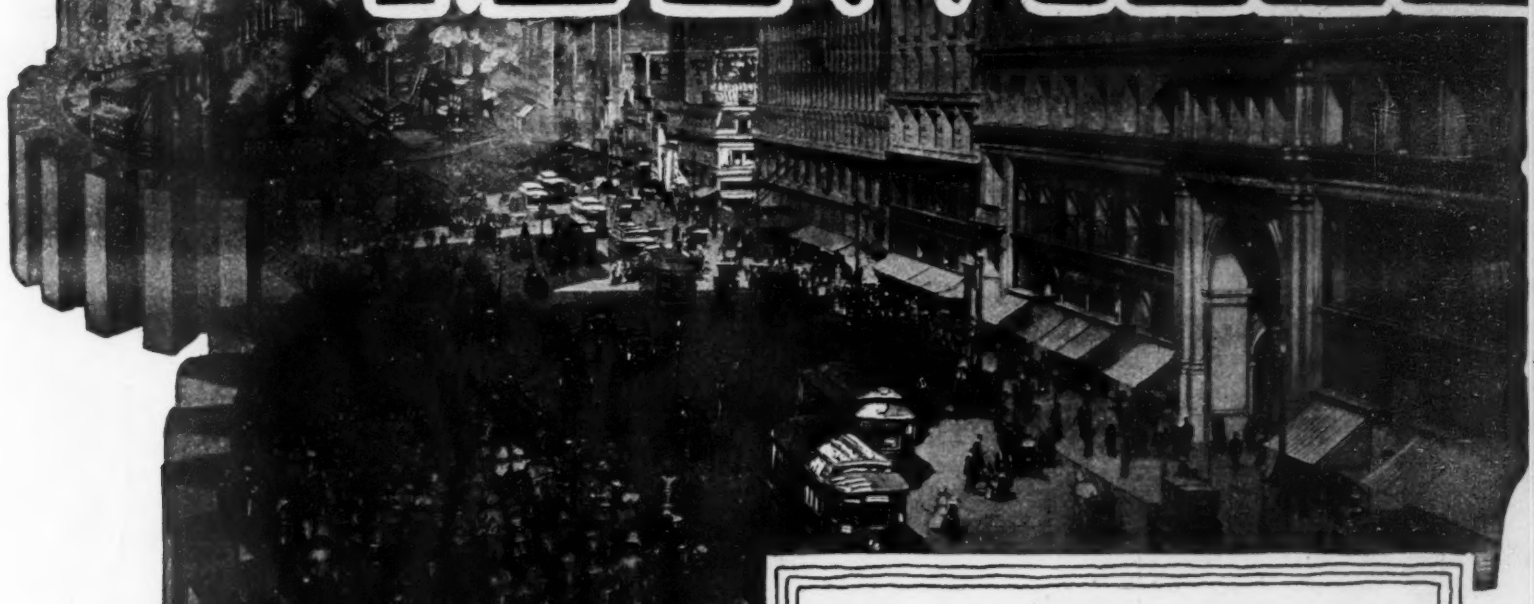
Some of the principal heads under which the divergence between hotel and army practice is emphasized are the utensils available, the character and extent of seasoning, the important place held in the military menu by cereals and dried vegetables, the cuts of meat used, and the stove upon which the cooking is done.

When Mr. Panchard first planned the work of the National Cooks Training Corps he supposed that about a thousand instructors would be all that would be required, but during a recent conference with Quartermaster General Sharpe it was figured out that if the army was to be well fed at least 3,800 experts cooks would be required to serve for the first six weeks in the sixteen cantonments. This was a very large undertaking but an appeal made by Mr. Panchard to every hotel and cooks' association in the United States makes it certain that this number of men will be fully prepared to serve Uncle Sam when they are called.

When the instructor cooks are once at work in the cantonments intensive training rules will be carried out by them for six weeks, with routine of actual kitchen work during the day a course of study and lectures at night. At the end of this time any army cook should be able to proceed with his work efficiently.

JOHNS-MANVILLE

JOHNS-MANVILLE SERVICE
COVERS THE CONTINENT



Behind the Power that Turns the Wheels of Your Life

YOUR food, your clothing, your equipment for life's work, come from the collective efforts of thousands of manufacturing plants, which in the struggle to meet your demands, compete in quality, in price, and in service.

To do this, these manufacturers must operate their establishments at highest efficiency—must protect their plants against countless costly leaks such as waste heat, friction, wear and tear, and breakdowns.

Many American manufacturers rely on Johns-Manville maintenance materials to check these losses. For example, they improve the efficiency of pumps and engines by packing them with Johns-Manville Sea Rings, the packing that reduces friction to a minimum. The brick arches over the blazing boiler fires are protected from the flame's white heat by Johns-Manville Refractory Cements. Again, the valuable heat transferred through pipes, ducts and flues is conserved by Insulations made from Johns-Manville Asbestos and Magnesia. And in hundreds of other instances, Johns-Manville materials are employed to reach you with a better product at the lowest cost.

So that of all the ways—some direct, some devious — by which Johns-Manville serves the public, none is more important than this function of maintenance, this power economy at the very heart-center of industry.

H. W. JOHNS-MANVILLE CO.
NEW YORK CITY
10 Factories—Branches in 54 Large Cities

A Johns-Manville Sea Ring

JOHNS-MANVILLE
POWER PLANT MATERIALS

A variety of specially developed insulations, including:

Asbesto-Sponge Felted Insulation
85% Magnesia Insulation
Asbestocel Insulation

Packing and other Power Plant specialties, such as:

Duplex Packing
Service Sheet Packing
Seigelite Sheet Packing
Mogul Valve Stem Packing
The Johns-Manville Sea Ring
Asbesto-Metallic Brake Blocks
Underground Insulation System for Pipes
The Johns-Manville Fire Extinguisher
The Johns-Manville Steam Trap
High Temperature Cements
Kearsarge Boiler Gaskets
Universal Piston Packing

THE "BULL DOG"

Mack TRUCKS

The Measure of Truck Value

MACK trucks have a definite investment value—just the same as a towering office building. Both earn steady dividends—not merely for a year or two—but for many years.

The initial cost of a MACK may be greater than that of an ordinary truck, but the MACK still pays regular dividends long after the other has been forgotten. For the MACK shows consistency and durability—factors to be found only in the best of everything.

It is by the tests of time and mileage that the true value of MACK performance is proven.

The numerous trucks with high tonnage rating and comparatively low prices make it imperative that you choose *your* truck by performance and not promise. Twenty years of uninterrupted production serve to establish the MACK as an investment—not a speculation.

MACK capacities, 1, 1½, 2, 3½, 5½, 7½ tons.

Tractors 5 to 15 tons.

Write for facts and figures

INTERNATIONAL MOTOR COMPANY
NEW YORK

PERFORMANCE COUNTS

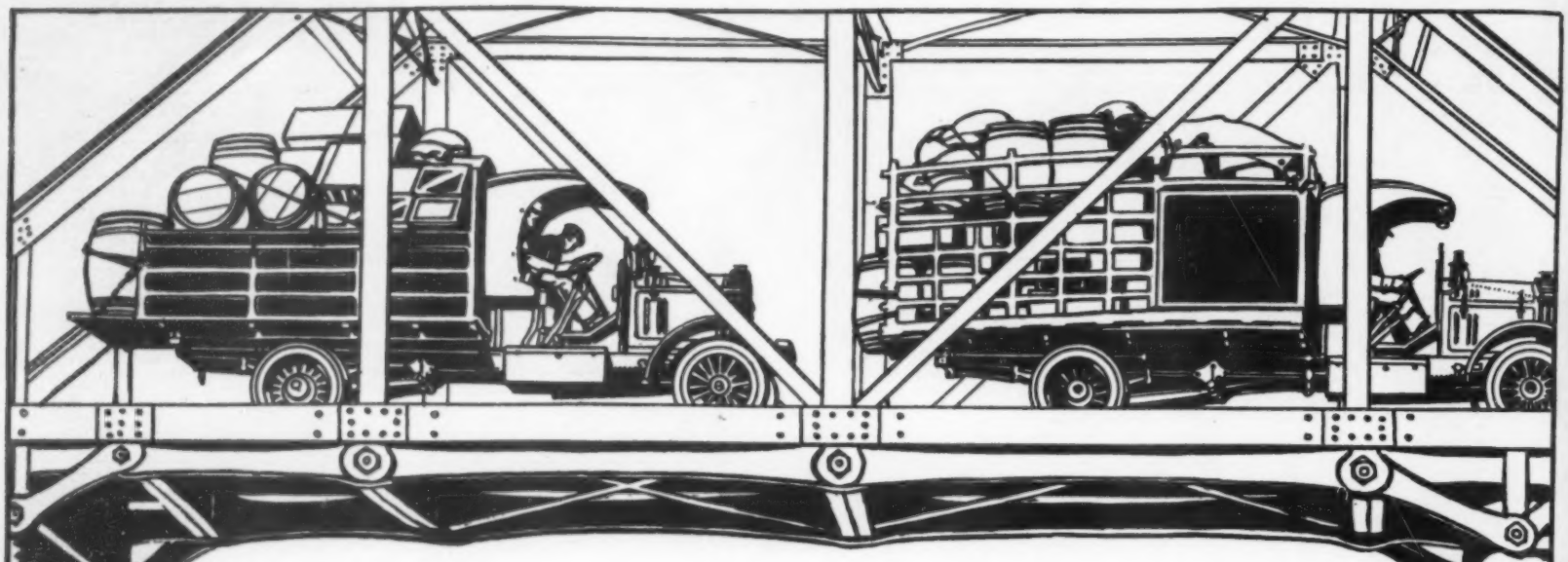
SCIENTIFIC AMERICAN

CAMOUFLAGE ROBES WORN BY THE CREW OF A FRENCH ANTI-AIRCRAFT CANNON—[See page 225]

September 29, 1917

Munn & Co., Inc., Publishers
New York, N. Y.

Price 10 Cents



Adaptability

An outstanding feature of Pierce-Arrow truck performance is adaptability. In the widest variety of haulage problems, ranging from the traffic of peace to the transport of war, Pierce-Arrow fleets have proved their ability to meet the most difficult conditions of service.

Single trucks have taken over the work of many horses and done it quicker, better and cheaper. They have developed new business by increasing delivery radius and opening up territory quite beyond the reach of horses.

They have eliminated the intolerable delays of freight congestion and embargoes by quickly and economically handling shipments formerly made by railroad. They have enabled manufacturers, formerly dependent upon a single outlet, to avail themselves of additional points of shipment and low water rates.

Specific data is available covering the cost of operation of Pierce rrow Motor Trucks in many different lines of business, such as Transport, Grocery, Contracting, Coal, Brewery, Textile, Oil, Dry Goods, Chemicals, etc.

The Worm-Gear

All Pierce-Arrow trucks are equipped with the worm-gear drive, which is a positive guarantee of effective service under the most difficult conditions.

Pierce-Arrow

Motor Trucks

THE PIERCE-ARROW MOTOR CAR COMPANY, BUFFALO, N. Y.